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The AUTOMOBILE

Science in Spring Manufacture

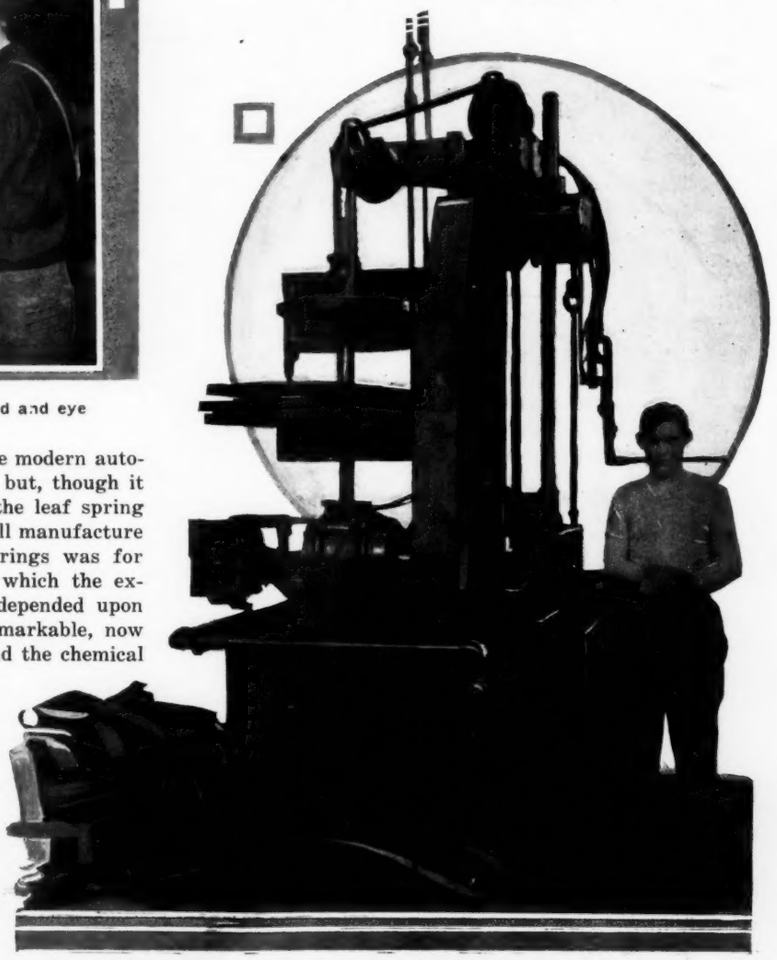
Brains and Machines Replace Skill of Hand and Eye

By A. Ludlow Clayden

The Old—Method of cambering springs by hand and eye

OF the many parts which go to make up the modern automobile the oldest probably is the wheel, but, though it was not discovered for centuries later, the leaf spring is without doubt the second in antiquity. Like all manufacture in the pre-machinery days, the making of springs was for centuries, an art; or rather, a handicraft in which the excellence or otherwise of the resulting article depended upon the skill of the workman. It is somewhat remarkable, now that we know so much about heat treatment and the chemical constitution of steels, that the old craftsmen managed to make such good springs in days when science was undreamed of, but it is perhaps still more remarkable that so generally useful an article as a leaf spring, which has remained unchanged in principle for so many years, should only quite recently have attracted the attention of real engineers of the modern school.

It has been the prerogative of America to create machines to do better work than the hand of man in the making of all sorts of things. Articles of diet, tools, vehicles and implements all owe their low price and their high quality to American mechanical genius either directly or indirectly; there is hardly a



THE NEW—Machine which cambers automatically, quenching the plate in same operation. As shown the dies are beneath the oil in the tank and the operator is ready to withdraw the plate when it has cooled. Observe the difference in the age and look of the boy as compared with the men in the illustration above

product of a factory the world over that has not American brains behind it in one way or another. Yet, and this is a most surprising fact, it is only within the past few years that the engineers of this country have turned their attention to devising processes which will cheapen and improve the leaf spring, without which it would have been difficult to develop any sort of vehicle with better riding qualities than the farmer's wagon. This despite even the pneumatic tire, for the spring does much that the tire can never do, just as the spring alone is of much reduced value when the air cushion is not available.

Old-Fashioned Spring Making

The way in which springs were made a century ago, and the way in which they are still made throughout Europe and in some American spring factories, depends almost entirely upon the skill of the men who forge and bend the leaves. Giving a piece of steel a spring temper is a very old art, but before the days of metallurgical research, and the pyrometer for measuring the high temperatures of a furnace, it rested with the workman to judge the correct heat at which to forge and quench the steel. By years of practice with the simple steels of years gone by, it was possible for a man to reach so high a degree of skill that he could make a very good spring indeed. In fact it is still to be noticed that spring making is often a family handicraft, the father instructing the sons and they their offspring from generation to generation.

It is perhaps, from the point of view of romance, and the pride of men in the skill of their hands, a pity that this state of things should be passing away, a pity that yet another of the ancient arts should give way before the all devouring machine, but laying sentiment aside, there is no doubt that a few short years will see a state of affairs in which a man can be trained into a spring maker as readily as he can be made an elevator operator. The smallest modicum of common sense suffices to operate a good machine, and the good machine for making springs is rapidly making headway. To the advantage, of course, of everyone who wants good springs of even quality, and cheaply.

The Importance of Material

Even if the machine will make better springs than the unaided man, there is another way in which the automobile demands more than was asked for the buggy. It is necessary to choose the steel to stand up under the vastly more severe conditions of the automobile. Just as we can use steel of low strength if we do not mind weight in an automobile frame, for example, so can we use low-tensile steels in a spring. But remembering that a spring is being constantly bent to and fro, it is obvious that some materials will withstand more of this treatment before tiring than will others. If one can measure the life of an automobile motor by the number of revolutions it makes, so many hundreds of millions perhaps—just so can the life of a spring be measured. Given definite dimensions and a definite number of leaves, etc., a spring will get tired sooner or later, according to the steel of which it is composed. Nor is the matter one of tensile strength only, it does not follow that the strongest steel will necessarily be the best for a spring, and here we come to the commencement of every successful modern spring factory, namely the engineering laboratory.

Laboratory—Alpha and Omega

In the plant of the Perfection Spring Co., Cleveland, O., one can just now see the old giving way to the new; the machine replacing the man as fast as new machines can be made and installed, so the factory just at the moment is especially interesting. In the following account of the procedure there we get a clear idea of progress from the past into the future and we must begin, as we shall end, with the learned scientist and the elaborate tools of his trade.

A separate building of two stories, lined with glazed tile and not unlike a hospital theater at first glance; such is the laboratory at this particular plant, and we must begin on the upper floor, where there is a chemical testing room. Having found by experiment downstairs, to be dealt with in a moment, what sort of steels make the best springs, it is essential to check the work of the steel maker to see that the specifications are adhered to.

There are several sorts of steel used in the making of Perfection springs, some better than others, according to the life for which the customer is prepared to pay and it is the chemist's business to take a piece from every tenth bar or so of the steel which comes into the stockroom and to analyse it. He finds if the impurities, which cannot ever be eliminated altogether, are present in too great a quantity; if there is the proper proportion of carbon, and of silicon or chromium or both. So this test is not child's play, but means the daily use of delicate apparatus. Here is one of the *few* highly skilled men that replaces the many which the old method called for.

Nor is his work all chemical, for there is alongside his bench a microscope which shows him the structure of the steel, though this is used more to check the stages of *manufacture* than for examination of the raw material.

On the ground floor in the same building are small heat treating furnaces and also testing machines of various kinds. There is a special sort of gas-fired furnace, in which degrees of heat can be regulated very accurately, and beside it is a bath of molten salt used for drawing the steel.

Tempering Modus Operandi

Here let it be interposed that in making springs the steel is heated to a high temperature, a bright red heat, and then bent into the proper camber, after which it is heated again at a lower temperature to bring it to its full strength. After cambering, while it is still very hot indeed, it is plunged into oil and so tempered. This leaves it brittle, and the purpose of the second heating is to remove this brittleness just sufficiently and without removing the springiness also, as annealing would do. The exact temperature at which the cambering is done and the proper heat for drawing vary with different sorts of steels, and the purpose of the laboratory furnace is to find out by experiment the proper heat at which to bend and quench the steel in oil. The salt bath, as it is called, is a metal vessel in which molten salt is contained, it being easy to keep the temperature constant at any desired degree of heat, just as it would be easy to keep water at any steady temperature below boiling by adjusting a gas flame beneath the vessel.

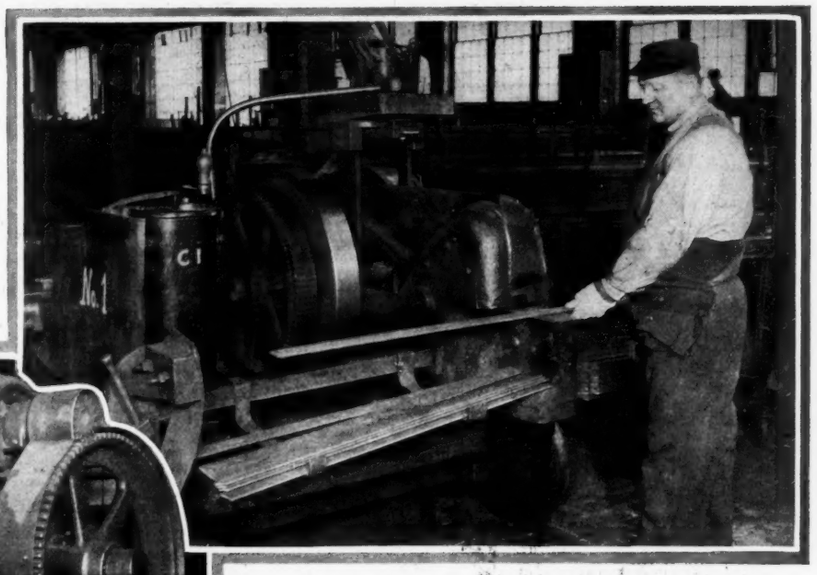
Thus steel spring leaves plunged into this molten salt take a perfectly even temperature, and when they have soaked long enough they are taken out and allowed to cool slowly in the air. When they are cold the laboratory men take them into the adjoining room and bend or break them in machines which test the absolute strength, the limit of elasticity, the degree of hardness and the number of times the plate can be bent to and fro before breaking.

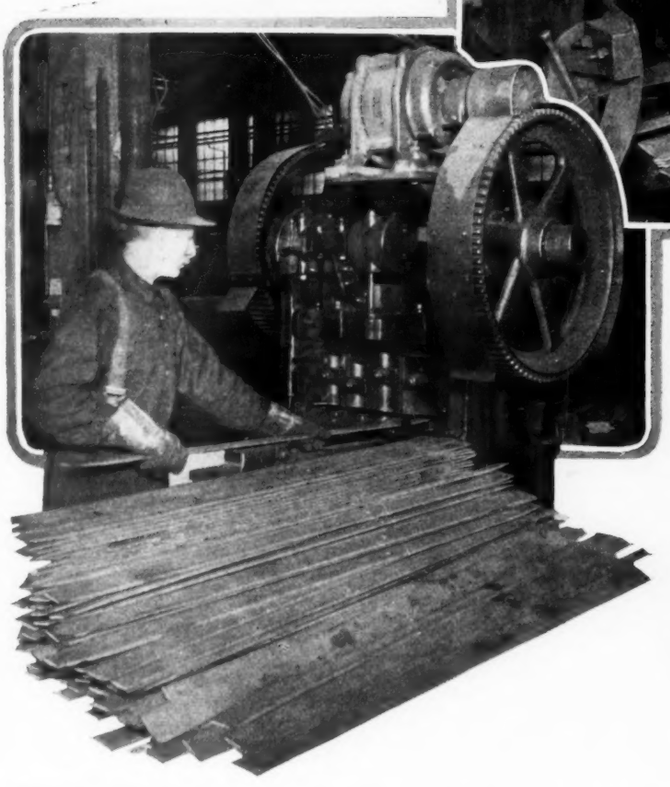
When all these tests have shown the laboratory superintendent the proper treatment for a particular steel, then shop orders are issued so that the steel shall be heated and cooled in the same way and to the same degree in the actual manufacturing process.

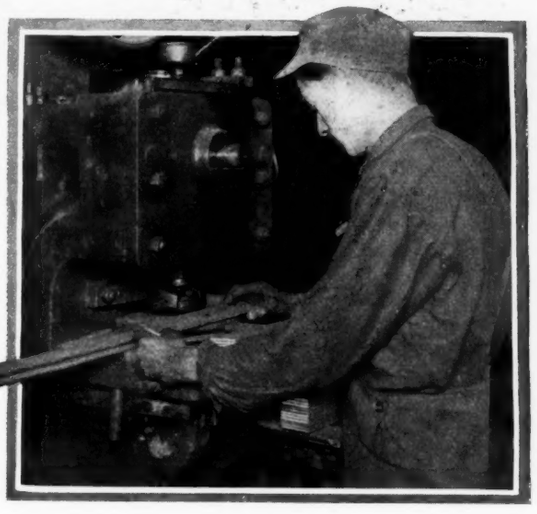
Checking the Quality

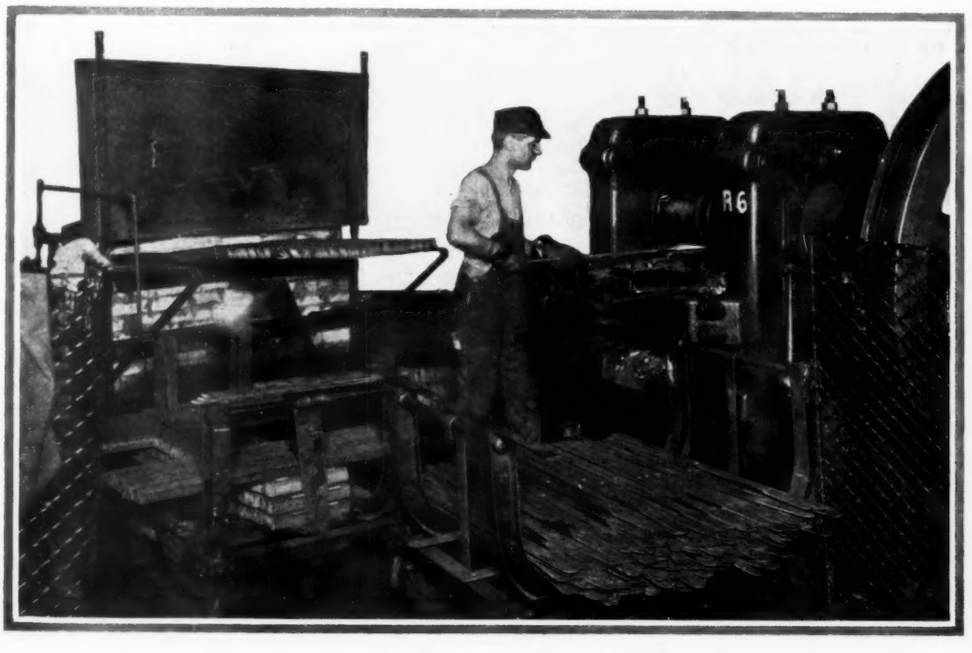
Not only is it necessary to find out the proper treatment, but it is equally vital to watch the factory in order to see that the large scale work therein properly mimics the laboratory researches. Thus test pieces are constantly taken from the shop furnaces and quenching baths and tested to destruction in the laboratory. From the figures thus obtained the results of laboratory tests on the sample pieces of steel taken

Left—The shearing machine which bites the bars of alloy steel into the proper lengths. Below—Cropping or trimming the ends of spring leaves. This is done on the cold steel





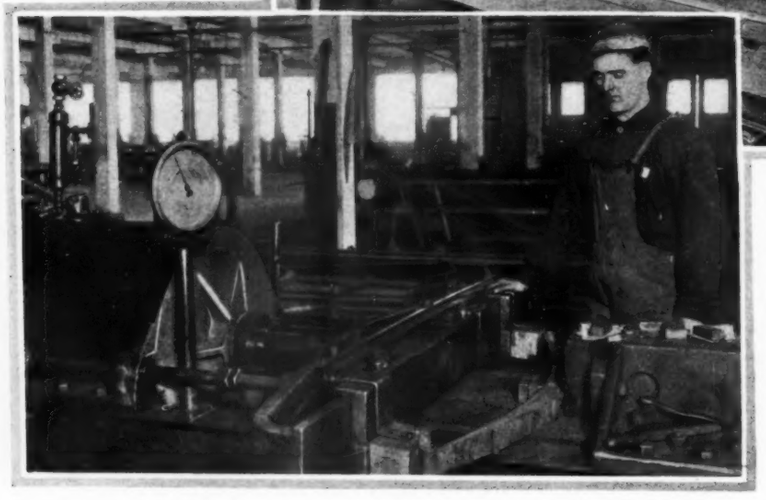




Above—Punching the center hole in a spring leaf

Left—Rolling out the ends of spring leaves to make the old type with rounded ends

Painting leaves with graphite and final assembling



Below — The Breakdown test which takes the first set out of the spring and precedes final assembly

from the stock room daily are tabulated alongside the results of tests on the same steel stock as taken from the factory furnaces. The comparison shows at a glance how closely the shops are approaching the ideal conditions and indicate where improvement is possible or necessary.

Laboratory First and Last

Thus the laboratory tells the shop how to work and then sees that it obeys instructions. It is in this way that the laboratory both begins and ends the making of springs, for it is equally responsible, firstly, for seeing that the instructions are correct and, secondly, for observing that those instructions are carried into effect.

Lastly, the laboratory has a machine appealing greatly to popular imagination in which every now and then a complete spring taken from stock is tested. This machine holds the ends of the spring and pushes the center up and down, just as an axle moves relative to the frame of a car, and after some immense period of time perhaps a plate breaks or the whole spring tires and loses strength. When these things happen research at once begins to find out why, if possible, and to seek means to make the next spring stand a greater number of deflections before it fails.

Shearing the Steel

Steel comes into the factory in the form of rolled bars, the thicknesses being different and the widths, of course, also being not all the same. It is supposed to be treated by the maker so that the quality is even, and this the laboratory checks in the manner that has been described. The steel is stored in great racks, and in front of these is a rail track, along which can be moved the cropping machines. An order comes along from the proper quarter for so many lengths of such-and-such a size of steel. The great machine is run into place opposite the proper heap of steel bar and the stock is fed between its giants jaws. A single bite suffices to clip through the toughest plate and the requisite lengths of steel drop off, to be collected, stacked and passed on.

There are two ways of shaping the ends of spring leaves, the old one is to roll out the ends and sides so as to lengthen the leaf a little and make its extremities into a half round. This is the usual sort of spring, and properly to roll out the ends needs a good deal of skill, for while the leaf may be *lengthened* it must not be *widened*.

The alternative method, which the Perfection Spring Co. believes to be better, is to crop or snip the ends to a blunt point, afterwards bevelling off the edges by grinding in semi-automatic machines run by boys. In either case the idea is to weaken the end of one leaf so that there is no sudden edge where the stress passes from one leaf to another. Either thinning the end by rolling it out, or cropping it to a point enables the stress on one leaf to flow into the next without sudden changes in stress—without a step, so to speak.

Of the two processes the cropping is preferred by this company because it calls for no heating, and the less a bit of spring steel is heated and cooled the better, except for the two essential tempering and drawing heats.

Punching Center Holes

Next comes the making of the hole in the center of the plate to accommodate the bolt which eventually will hold the spring together, and this may in practice precede the operation of end shaping. The holes are made by a punch, and in some of the Perfection springs this hole is afterwards cupped on one side so that one plate is automatically registered with the next. To do this it is necessary to heat the middle part of the plates, but the operation of making the hole needs no unusual skill, nor does that of cropping and bevelling the ends to a diamond point.

Cambering the Leaf

Even a spring which is to be flat when in position on the car, has to have its leaves cambered, or bent to a curve, for it is the flattening out of the spring's natural curve that enables it to support the load elastically. It is in this operation that the old process calls for the greatest skill, but before coming to this let us consider the furnaces in which the plates are heated before cambering.

Even before this process the top plates have to have the eyes on their ends rolled up to accommodate the bush for the shackle bolt, and this is done by heating the end and then inserting it in a machine which takes hold of the leaf and pulls the end around by a sort of cam action. Curiously enough, this apparently simple machine has proved troublesome to get just right, so an alternative method is to bend

the end of the plate over a series of dies. There are usually three bends in this tool, and they may all be done in succession without reheating if the plate is thin enough. With a thick plate reheating is necessary after the major amount of bending is done. The tool is quite simple as it consists of jaws which bite the end of the leaf between curved surfaces, so forcing it to conform to the dies. The handling of either type of eyemaker is easy and to learn to do the job is neither a long nor difficult process.

To return to cambering, the plates are placed, on edge, in a furnace which is kept rigidly to the temperature which suits the steel being used at the moment, and they stay therein long enough to soak at the full temperature the proper length of time. To get this effect, instead of putting in a furnace-full and taking them all out at once, only two or three plates are withdrawn at a time, cold ones being put in to take their places.

Master Pyrometer System

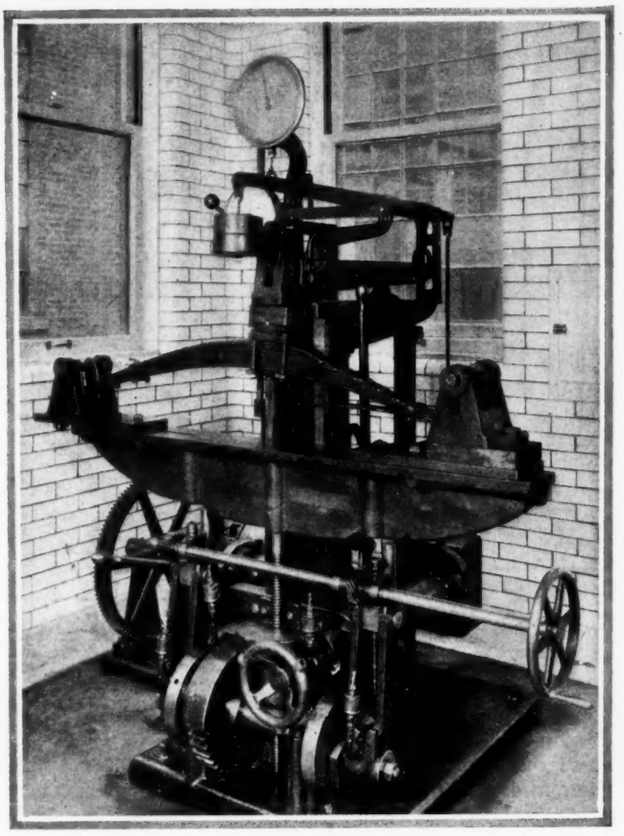
Now, it is the most important thing in the world that these furnaces should not be so cold that the plates are strained by cambering, nor so hot that the strength of the steel is impaired. With modern alloy steels this means that only a few degrees variation is allowable. To keep this checked all the time an electric pyrometer, or high temperature thermometer, is installed in each furnace and the wires leading to the recording board are brought into a little room in the main office building. Here there sits a woman, whose sole duty is to read the temperature of one furnace after the other without ceasing. One girl comes after another, and day or night the record is kept.

On the desk beside the operator is a telautograph, on which the record is entered, and the other instrument is on the foreman's desk in the shop beside the furnaces. At every minute of the 24 hours of the day this record continues; the foreman sees to the adjustment of the oil burners to give more or less heat as required, and the furnaces are kept at the proper degree. This elaborate system takes out of the hands of the shop the keeping of the record, so there is no chance of error unless one of the pyrometers should fail, and repeated laboratory tests of these maintain their efficiency. If a heat is wrong there stands an irrefutable record of the mistake; there is not the smallest chance of human fallibility.

The Old and the New

So much for the heating. In the old hand-method each plate as it came from the furnace was seized upon by two men who gripped it between the jaws of tongs, and bent it by hand to a curved template. By eye they judged the accuracy of the curve, by hand it was made, and by hand the plate, still red hot, was plunged into a bath of oil. Now this produces excellent work so long as the men are utterly reliable, but it is easy for one lacking in skill or in care to bend a little wabble in the plate or to twist it a little, and plates as bent and quenched by this method are seldom really true and have afterwards to be corrected by hammering, which calls for more highly skilled labor and is none too good for the steel.

The pyrometer record board which is watched from year's end to year's end. From it are regulated or checked the temperatures of all the furnaces. The operator writes on the telautograph in the background which transmits a written message to the furnace foremen



The laboratory machine which tests springs to destruction by repeated flexure up to hundreds of thousands of reversals to the limit of elasticity

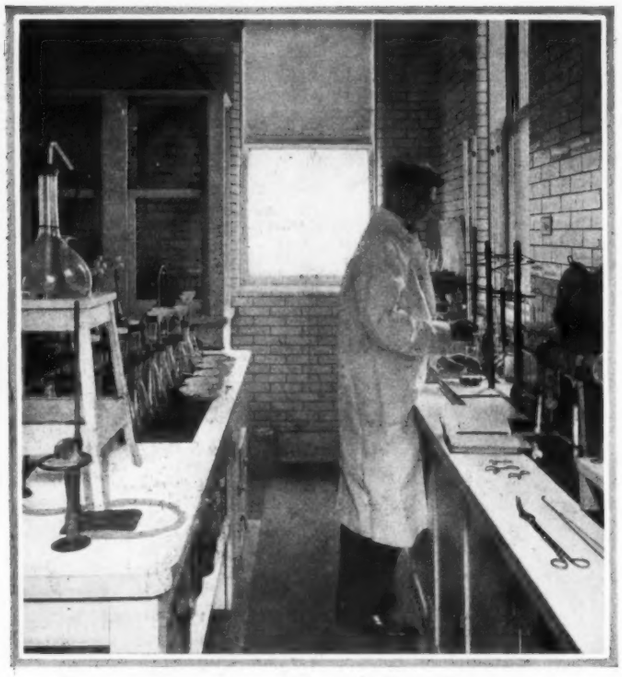
The new way is to pull the plate from the furnace, drop it on a die in a machine, pull a lever which brings down another die on top of the other; so squeezing the plate to absolutely true form, and then, in the same motion, sousing plate and dies beneath the surface of oil in a great tank.

Not only is the new process quicker, but the human element is eliminated. In a few moments, almost, a man could get the knack of dropping the hot plate on the dies, for it is located by the center bolt hole, and once it is in place the machine sees to the rest.

At the Perfection Spring Co.'s plant, as has been said, both the old methods and the new are to be seen, because the machines cannot be made fast enough to eliminate all handicraft. In a short time, however, this will have been done and the hit-and-miss methods removed forever, so saving expense and waste material in the form of scrap. The machine improves the average value of the product because its action is regular, and it simplifies manufacture and inspection to an immense extent.

Next Stage Is Drawing

As has been explained the plate is now in finished form, but it is far too brittle, so it passes to another furnace,



Analysis part of laboratory where chemical constitution of steels used is checked

where the temperature is lower. Here it soaks for a predetermined time, the heat being checked by the pyrometer as before, and when a load of plates have had their heat bath the carriage upon which they rest inside the furnace is pulled out and the plates allowed to cool off at their leisure. This is called drawing the temper.

The salt bath, as explained in the laboratory equipment, is used also for drawing, as it enables the heat to be kept even, more readily than the usual type, but there are some mechanical difficulties in connection with large salt baths which render their complete adoption a little difficult.

Final Stages—Grinding and Buffing

Now, when they are cooled, the plates are covered with a thin layer of scale, due to the heating, and this is removed by grinding and buffing with abrasive wheels. This completed to the inspector's satisfaction, the plates of different sizes meet each other for the first time to be bound up into the completed spring.

Steps in Assembly

It is found that a spring when first assembled has a greater set than really belongs to it, so it is put in a machine which bends it to the limit that it is ever expected to be bent, beyond that limit in fact. It is found that after this first bend it does not recover its first shape completely, but takes its final, natural form which only age in use or accident can ever alter. It must return a given degree or it means that one or more of the plates are not up to standard, but if all is well the spring comes apart again, has the leaves painted with graphite and is assembled finally with center bolt and rebound clips, being then ready for shipping.

Pressing Bushings Into Eyes

Intermediately between cooling after drawing and the removal of scale from the top plates of springs comes the pressing into the eyes of the bronze bushings, and grinding the eyes to proper width. This is done by pushing the end of the plate between two revolving grinding wheels, which operate equally on both sides of the eye and prevent the proper width from being obtained lopsidedly by grinding off too much one side and not enough the other, as might be possible if the sides were ground one at a time.

There is a rigid final inspection, and throughout the stages through which each part passes are detail inspections, but these have not been mentioned as they have nothing to do with the process per se.

Quantity and Quality

Thus told the tale is simple, so simple that it strips the glamor from the spring maker's art, and show it as a simple sort of manufacture, devoid of mystery, which indeed it is. But, let it not be forgotten that the coming of machinery has been made possible only by master brains, that the delicacy of the heat treatment derives its practicability from the work of men of science in many lands, and we see that for the hand skill of the many is substituted the brain force of a few. We have in such a plant as this, replaced *quantity* of craftsmanship by *quality* of direction, and with a few highly trained minds controlling a force of unskilled labor we get a better product than could possibly have come in quantity from all the handicraftsmen in the world.

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Owner Not Responsible for Chauffeur on His Own Errands

NEW YORK CITY, May 8—The owner of an automobile is not liable for an accident caused by his chauffeur while the latter was driving the machine on an errand for himself without the knowledge of the owner, though he had frequently used it in doing errands for himself without asking for or receiving express consent, and the owner had not forbidden such use, according to a decision handed down recently in the Court of Appeals by Judge Collin.

Annie Reilly was injured by the car of A. W. Connable, operated by the chauffeur of the latter on an errand for himself, and brought suit to recover damages from Mr. Connable. The appellate division of the Supreme Court in the second judicial department affirmed a judgment in favor of the plaintiff entered May 7, 1913, and the decision just delivered by Judge Collin on the appeal, reverses the finding of the lower court.

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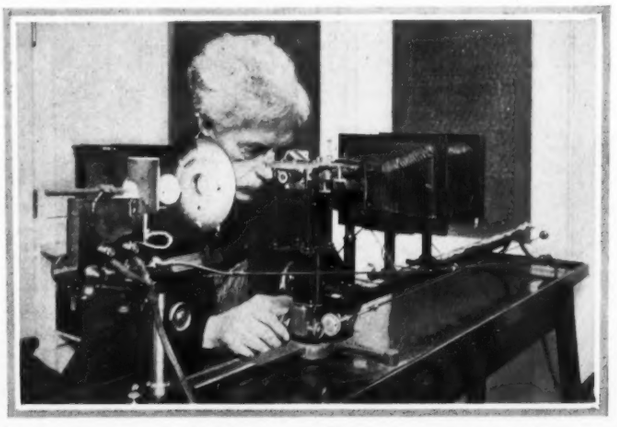
Reo Chassis for University of Michigan

LANSING, MICH., May 7—The Reo Motor Car Co., Lansing, has furnished to the automobile laboratory of the University of Michigan a complete 1915 Reo the Fifth chassis for demonstration and lecture use before the classes in Automobile Engineering. Tests upon the various chassis units may also be run by squads of advanced students in the automobile laboratory testing course.



Professor Leonard examines a polished bit of heat treated steel beneath the microscope

Truck Makers to Decide on Standard Service Policy

Sentiment at Detroit Convention Is Opposed to Shows for Commercial Vehicles But Favors N. A. C. C. 90-Day Warranty—Next Meeting in October or Earlier

By L. V. Spencer

DETROIT, MICH., May 6—Sentiment among commercial vehicle manufacturers as a whole is opposed to motor truck shows; they favor the 90-day standard warranty of the National Automobile Chamber of Commerce, and they have acted to devise a standard service policy. These important matters and many others of vital interest to the commercial car industry were taken up in the 2-day Motor Truck Convention here under the auspices of the N. A. C. C., which was brought to an end tonight. It was also voted to hold the next convention in October or even earlier at the discretion of the Chamber.

The gathering was an unqualified success, viewed from every angle. More real business was transacted than at any previous meeting of the truck men, and a great deal was accomplished to weed out the undesirable features of the industry as it is today. Price cutting was dealt a blow by the sentiment of the delegates, and what was even more important, a committee was named to decide upon a form of service policy to do away with the indefinite and expensive service methods now being practiced in a more or less haphazard manner by the makers and their dealers. In order that this policy may represent the views of all factions, a committee of five nonmembers of the N. A. C. C. was appointed to work in conjunction with the commercial vehicle committee of that body.

The convention heard the pros and cons of selling trucks on time payments, and it discussed at length the question of how to handle the growing problem of the used vehicles. The need of a standard means of arriving at a truck's load rating was recognized, and suggestions of a formula to cover all types of vehicles were considered, although no definite action was taken at this time. Much thought was paid the dealer in the discussions and the papers, for it was felt that he must be given more assistance and help in his selling problems if the makers are to survive. The idea held by some that the dealer cannot make money if he handles his business judiciously was nailed as a bad mistake.

MOTOR TRUCKISMS

The commercial vehicle business should be second only to the railroads.—M. L. Pulcher, vice-pres. and gen. mgr., Federal Motor Truck Co., Detroit.

No man living can determine the value of a used truck by a superficial examination. . . . The used truck question can be handled just as the shoe merchant handles the used shoe question.—W. L. Day, gen. mgr., Commercial Motors Truck Co., Pontiac, Mich.

The dealer is the most satisfactory channel through which to sell trucks.—Robt. O. Patten, Truck Sales Mgr., Pierce-Arrow Motor Car Co., Buffalo.

The future of the electric truck does not lie in displacing the gasoline truck, but in ousting the horse. . . . The future of the electric truck is the future of electricity.—P. D. Wagoner, pres., General Vehicle Co., Long Island City, N. Y.

No other branch of industry with which I am familiar gives, as a general proposition, so much in the way of free service as our own automobile business.—Alvan Macauley, vice-pres. and general mgr., Packard Motor Car Co., Detroit.

The discussion which subsequently led to the appointment of a standard service policy committee was one of the most enlightening and valuable parts of the session. The feeling was general that the indiscriminate giving of service should be curbed and that a policy to which all could adhere uniformly would be of the greatest value. It would give the dealers something to go by, and there would be less tendency on the part of truck owners to abuse the liberal good will of the maker and dealer.

The commercial vehicle committee of the N. A. C. C., consisting of W. T. White, president the White Co., Cleveland, chairman; Alvan Macauley, vice-president and general manager, Packard Motor Car Co., Detroit; P. D. Wagoner, president, General Vehicle Co., Long Island City, N. Y.; H. Kerr Thomas, assistant manager, Pierce-Arrow Motor Car Co., Buffalo; and M. L. Pulcher, vice-president and general manager, Federal Motor Truck Co., Detroit, will be assisted by the following five truck men whose firms are not members of the organization at this time: V. E. Brown, president, Sternberg Motor Truck Co., Milwaukee; E. T. Birdsall, president, Kosmath Co., Detroit; Henry Lansdale, vice-president, Denby Motor Truck Co., Detroit; J. C. Millman, secretary-treasurer, Stegeman Motor Car Co., Milwaukee, and H. E. Wilcox, vice-president, H. E. Wilcox Motor Co., Minneapolis.

They will seek to arrive at some definite and sound basis for free truck service, and will report at the fall meeting of the manufacturers.

The service policy subject was opened by Alvan Macauley, whose paper was entitled Can Manufacturers Have a Standard Service Policy? Mr. Macauley thinks they can, and he is very clear in his paper as to the reasons why. W. L. Day, general manager of the General Motors Truck Co., Pontiac, Mich., is equally sure that no free service policy is required. His company has cut out entirely what is known as free service, and he believes that under this system the owners take better care of their vehicles because they are on their own responsibility

Warranty No..... Vehicle No.....

This is to Certify that we, the

Sample Motor Vehicle Company

of Detroit

Warrant *each new motor vehicle manufactured by us, whether passenger car or commercial vehicle, to be free from defects in material and workmanship under normal use and service, our obligation under this warranty being limited to making good at our factory any part or parts thereof which shall, within ninety (90) days after delivery of such vehicle to the original purchaser, be returned to us with transportation charges prepaid, and which our examination shall disclose to our satisfaction to have been thus defective; this warranty being expressly in lieu of all other warranties expressed or implied and of all other obligations or liabilities on our part, and we neither assume nor authorize any other person to assume for us any other liability in connection with the sale of our vehicles.*

This warranty shall not apply to any vehicle which shall have been repaired or altered outside of our factory in any way so as, in our judgment, to affect its stability or reliability, nor which has been subject to misuse, negligence or accident, nor to any commercial vehicle made by us which shall have been operated at a speed exceeding the factory rated speed, or loaded beyond the factory rated load capacity.

We make no warranty whatever in respect to tires, rims, ignition apparatus, horns or other signaling devices, starting devices, generators, batteries, speedometers or other trade accessories, inasmuch as they are usually warranted separately by their respective manufacturers.

In Witness Whereof *we have caused this Warranty to be signed by our duly authorized officers.*

.....
Company Name

....
Signature and Title of Officer Signature and Title of Officer

Date....., 191

Standard Warranty approved by the N. A. C. C.
December 3, 1913

with them. Also the free inspection and minor adjustment service which Mr. Macauley advocates does not meet with Mr. Day's approval, as he contends that it brings about carelessness, and might encourage damage suits should anything go wrong with the vehicle after an inspection by the dealer or branch.

Divergent Views of Service

It was between these two men that the discussion was the liveliest. Each representing a strong factor in the industry, and with views on the matter of service so widely divergent, it was a case of submitting telling arguments pro and con, with the rest of the convention generally acting as the jury, although some of the others voiced views on one side or the other. Mr. Day laughingly accused the convention of being afraid to put so rigid a policy as that of the General Motors Truck Co. into effect, though they all realized that it was based upon sound business. He said that it was a big step to take, but that once taken it would prove itself.

The Packard Policy

Mr. Macauley outlined the new Packard dealers' service policy, under the provisions of which the dealer will, for one year, inspect monthly the trucks he has sold, and make minor adjustments gratis, if the truck is brought to his service department for attention. If not brought to him, and he is obliged to send a workman to wherever the truck may be located, he will inspect and adjust monthly for one year, doing whatever work can be completed within 3 hours at each visit, for a schedule of charges as follows:

Within a 10 mile radius	$1.50
Within a 20 mile radius	2.50
Within a 30 mile radius	3.00

Beyond 30 miles a special arrangement is made in accordance with the distance.

Within the first month after delivery, adjustments are made as often as the owner desires, providing he brings the truck to the service station. After that, regular rates are charged except for monthly inspections. If delivered within 100 miles, the dealer will also provide an instructor for 3 days in order to acquaint the driver with the truck.

The General Motors Truck Co., on the other hand, is really the pioneer in the policy of not according any of this free service, charging for any attention to the truck from the very outset, at its regular repair rates. Mr. Day stated that it was being followed with success throughout the entire dealer and branch organization, and was making more careful truck men out of the owners.

Too Much Free Service

Most of the delegates felt that they are now giving too much in the way of free service in order to allow the dealers to make money, for much of the profit which they get on the vehicle is eaten up in the gratuitous work done to keep the owner satisfied afterwards. Mr. Macauley called attention to this by saying that no other branch of industry with which he is familiar gives, as a general proposition, so much in the way of free service as the automobile business.

He goes on further to say:

"The existence of this liberality of free service is undoubtedly due to the fact that as soon as the automobile business was born, scores of manufacturers took it up simultaneously, and from the very outset there was the very keenest competition, which patrons availed themselves of to extract from motor car manufacturers most lavish promises, either expressed or implied, as to what would be done for them without charge. In nearly every other line of business, history shows usually some one pioneer who developed it to the point of success, and who established precedents as to repair work and service before he had serious competition, and, under these circumstances, the pioneer manufacturer did not make extravagant promises of free service, and later manufacturers who came into his field usually fell in with the precedents he had established.

"What kind of service is promised you when you buy a yacht, or a gun, or a locomotive, an installation for your power-plant, machine tools, an elevator, or whatnot? In all of these lines we expect the manufacturer to make good if he sells us an article that is below his established standard of excellence. Also, we know perfectly well that if we ask him to do anything more, we shall expect to pay the bill for time and materials, and a reasonable profit. Custom has educated us what to expect, and we accept the result without any feeling but that it is only fair and right to pay the bill. The public generally is willing to pay what it thinks is fair, but what it thinks is fair depends entirely upon its education, and I feel that we have all failed in our duty towards our patrons and our dealers in not educating them as to what is right and economically possible in the way of service. We have either left them in an indefinite frame of mind, or worse, we have led them to believe that we are willing to give more than we should give, and are able to give.

"The public naturally will take all the free service it can get, and whatever is given is accepted as a matter of right."

This sentiment against indiscriminate and lavish service was voiced by all who spoke, but none seemed to feel that they could follow the lead set by Mr. Day, although they agreed that it was the ideal method.

A Delicate Point

Vernon Munroe, president of the International Motor Co., cautioned the truck committee to approach the subject with the greatest care, as it is a selling policy, and one which must be fair and equable in order for all to abide by it.

W. T. White pointed out that no policy which the N. A. C. C. or any similar body could devise would be absolutely binding, but it would form a basis for individual policy and serve as a moral support. He characterized it as a beacon light—something to steer by.

A great deal of interest was evidenced in the used truck

question. Here again Mr. Day struck a body blow at the present policy of taking used trucks in part payment for new ones, often at exorbitantly high amounts so that the dealer was not able to get a profit after disposing of the old car. His answer to the topic, How Can the Used Truck Question Be Handled? and on which he read a paper was that the motor truck makers can handle the used car question just as the shoe merchant handles the used shoe question. His company does not take any truck in part payment for a new one, and the plan is working to his satisfaction.

H. H. Hills, sales manager of the Packard Company, believes that Mr. Day has hit the nail on the head, although he stated that the used truck problem cannot be wholly eliminated. Failures, new and better trucks, lighter and faster types are all developments which make older cars become obsolete, and someone must handle them. He believes that a salesman handling *used* trucks should not have anything to do with *new* truck business, as he is apt to be unfair to one or the other in order to follow the lines of least resistance in making the sale.

Business Conditions and Used Trucks

H. E. Wilson thinks that general business conditions are in part responsible for the used cars on the market, and that often a dealer, to hold the trade of a good customer, will have to take in an old truck.

Mr. Pulcher of the Federal outlined his company's policy of getting each dealer to report to the factory periodically just what used vehicles he has on hand, and whenever a certain type or size is wanted, the dealers write the factory to learn where they can get such a truck from another dealer. Alfred Reeves explained the used car market report scheme used by Chicago dealers as a basis for prices on second-hand cars. This gives them a fixed value, and is something for the dealer to work on. It is primarily for passenger cars, but is being extended to trucks as well.

Opposed to Truck Shows

In putting itself on record as opposed to truck shows, the convention was practically united on the matter. Only two spoke in favor of shows, these being M. L. Pulcher, who read a paper in support of them, and Alfred Reeves, general manager of the N. A. C. C. In seeking to establish them, Mr. Pulcher pointed out that they should be entirely divorced from the passenger car exhibitions, as these detracted from the more staid truck shows that have in the past followed the passenger car weeks at New York and Chicago. He wanted to have an outdoor affair at some central point so that the ability of the various vehicles could be demonstrated. Such an event could be held in the fall when the passenger car business of the dealers is slow and would not interfere.

The dealers would get a new spirit of enthusiasm out of such a show, Mr. Pulcher added, and pointed out that in past exhibitions too much contradictory data has been given the prospect, who went away bewildered by the many conflicting claims he had heard. There has been too little of the educational spirit.

Truck Field Days at Sheepshead Bay?

But the convention was not with him, although Mr. Reeves explained that when people will pay to see what you have to sell them then they are interested. This interest was further attested at the recent national shows, he said, by the record breaking attendance. Truck shows could be made more profitable by bringing to them interested prospects, and by demonstrating loading and unloading ability for various classes of service. He thinks the new Sheepshead Bay speedway will be an excellent place to have truck field days.

There were some in favor of a truck field day, although the advantages of this were questioned. Many felt that interested buyers would not come to a show, but would go to the factory or the salesroom of the maker's agent in preference.

In some quarters exhibits in connection with state fairs were greatly favored as being a direct means of getting to the prospects not in the big cities. J. C. Millmann, of the Stegeman company was particularly in favor of this method of reaching local buyers, saying that makers have been overdeveloping the large cities and forgetting the bigger markets at large.

Mr. Macauley of the Packard company is not very enthusiastic over shows, and has seen no case where they paid direct results. Delegates from Pierce-Arrow, Knox, White, Autocar and International Motor Co., declared themselves against shows as a general proposition, though some of them were interested in the field day idea of demonstrating and thus provoking the interest of the general public.

Standard Warranty Approved

The members of the convention apparently had the matter of the N. A. C. C. standard 90-day warranty all thought out beforehand, for it was approved without much discussion as being the most advisable way to handle the question of replacements. This warranty is now in use by a large number of manufacturers and is proving satisfactory. It is fair because any defective materials or workmanship should develop in 3 months of reasonable service. It gives a good basis of adjustment, and now a concern would really be foolish not to work under its provisions.

Time Payments Discussed

W. T. White took up very logically the Advantages of Selling on Time Payments and How Such Sales Should be Handled. He laid down a good rule to follow in such business by saying that there are three classes of sales. They are, first, cash sales, second, reasonably short time sales where the buyer has a good financial standing in Dunn and Bradstreet, but whose ready cash is limited, and third, the time payment sales where the buyer has poor rating and a risk is taken in selling him. Mr. White pointed out that good business would sanction making sales in the second class, but that in the third, they should be undertaken guardedly after thorough investigation of the case. He dwelt upon the importance of exacting monthly payments in the latter kind of deals, as it beats the system of agreeing to take the balance in a lump sum in 6 months or a year. The security in the truck is always getting better with the monthly method.

Cost of Handling Important

The cost of handling time payments is of great importance, Mr. White said. He cited the sewing machine business, with which he is also connected, as being a good example of time payment plans in their most aggravated forms, because such goods are sold in small instalments to workers, and the like. In this line, the loss is about 10 per cent. but the cost of handling is not over 1 per cent. as one man and a stenographer can handle a million dollars worth of it so far as the office work is concerned. Mr. White has also found that it does not hurt the business to repossess goods when the buyer does not meet his payments. The public rather regards it as good business on the part of the seller.

All agreed that time payments were a good way to conduct the selling in cases where proper security is given. Methods of working this through dealers were discussed, and the brokerage business in payment notes was taken up. It was evident that the delegates thought notes a necessity to such transactions.

Dealer Best Selling Channel

C. W. Squires, Jr., sales manager, General Vehicle Co., suggested that dealers not be allowed their commission on time sales until all the payments have been made. The manufacturer takes the risk, he said, and since he has to wait for

his money, the dealer ought to also. This would tend to discourage partial payment sales unless absolutely necessary.

R. O. Patten, truck sales manager of the Pierce-Arrow company, read a paper in which he answered the question: Can a Dealer Make Money Selling Motor Trucks? He believes the dealer to be the most satisfactory channel through which to sell trucks, providing he gets the cooperation of the manufacturer. Ordinarily he has too little ammunition from the maker. Not enough confidence is placed in the dealer who should know such things as chassis weight, horsepower, speed, gasoline consumption, etc., and thus could talk intelligently to the prospect without making extravagant statements. The prospect often gets the impression of being deceived through no intention of the dealer.

Dealers can make money if the factories operate in an educational way, if they do not cut prices nor give too much service free, and if they only take in old cars on a proper basis. These were the general sentiments on the subject.

Need for Standard Load Rating

H. Kerr Thomas submitted a formula for arriving at a standard load rating, which he believes would apply with justice to all trucks. This would prevent much of the present difference in rating when one make of truck rated at 2 tons, for example, is smaller than another 1 1-2-ton make. The Thomas formula would take into consideration road weight, load capacity, size of engine, gear ratio and so on. It was praised though no action on it was taken at this time.

E. T. Birdsall said that the Thomas formula seems a good method of rating, but it has its limitations. In applying it to small sizes of trucks he finds that it brings the motor too small for the car, and from a selling point of view it is not advisable to put a small motor in the vehicle even if it will do the work. It is particularly good, though, because it is based upon practice with a number of makes of cars.

Future of Electric Truck

The future of the electric truck was considered in a paper by P. D. Wagoner who said that the future of this type of car is the future of electricity. He believes that to electric trucks is due the credit of having borne the brunt of truck introduction, for they were first in the field, and did the missionary work of showing the public how much they had the advantage over horses. This led the gasoline makers to enter the field. The slowness of the electric truck business is laid to the lack of knowledge of what they will do, and to the enterprise of the gasoline machine salesmen. The future of the electric does not lie in displacing the gasoline type, but rather in displacing the horse and working in cooperation with the gasoline type. Both types have a field, and in its field, the electric is supreme, Mr. Wagoner explained.

Investigate Service Conditions

Vernon Munroe, president of the International Motor Co., dealt with the subject of, Why Service Conditions Should Be Investigated and Recommendations Made Before Selling a Customer. The truck business should be reduced to a machinery basis, he said, and each installation carefully considered before making the sale, because this pays in the end.

W. P. Kennedy, traffic engineer, emphasized the importance of conservative investigation of proposed installations, particularly quantity installations. High priced traffic men are not justified in the organizations of the average truck maker of the present unless such men can be made to serve other purposes as well. In making an investigation looking to the installing of one or more trucks, Mr. Kennedy cited instances to show how important it is to deal with the man having the final say as regards purchase thus saving time and trouble. Often the expense of an investigation can be worked so as to have the purchaser bear a share of it, since he is getting valuable information as to how best to operate his vehicles at the same time he is being shown the advantages of the make under trial.

David Beecroft, Directing Editor Commercial Vehicle, pointed out the need of having buildings properly constructed so as to shorten the loading and unloading waits, which are the biggest factor against efficient truck operation. These delays are due to improperly designed loading docks, freight terminals, narrow and congested streets, and so on. Special vehicles for special service were also his plea.

Legislative Co-operation Advised

The sentiment was also expressed of cooperating with legislators to get laws which will not be oppressive. At this time many adverse bills are in prospect, but rather than try to buck the legislators, the N. A. C. C. and the manufacturers individually should seek to work with them to get the best laws that are possible. It was felt that with the increasing use of motor vehicles, taxation for roads must come to a greater extent for the communities themselves cannot afford the expense. Thus it should be seen to that if such heavier road taxes are imposed the money be actually put to road improvement purposes rather than being diverted to other civic channels.

How to Improve Conditions

J. W. Van Allen of the Atterbury Motor Car Co., Buffalo, gave his ideas of what can be done to improve the truck business. He outlined the existing difficulties that militate against efficient truck service, touched upon the promiscuous service methods in vogue, the evils of the used car side of the business, the dangers of price cutting, and suggested some remedies.

The discussion of his paper showed a sentiment against the small maker who is getting into the business to assemble a few cars and often sells them at ridiculously low prices to get started. They believed the parts makers to blame for this condition, but when it is considered that the latter makers can never tell when a small fellow will grow into a real factor, they can obviously not discriminate if they are looking to the future and do not want to take any chances of losing good trade later.

N. Y. Car Registrations Are 159,715

ALBANY, N. Y., May 8—Registrations in New York City in 1915 show a 33 1-3 per cent. increase over last year, according to an official statement issued by Secretary of State Hugo.

From February 1 to April 16, inclusive, 17,138 cars, 40,918 chauffeurs and 567 dealers received licenses, as against 52,034 cars, 35,984 chauffeurs and 492 dealers registered last year. This shows a gain of 25,104 cars, 4,934 chauffeurs and seventy-five dealers over 1914.

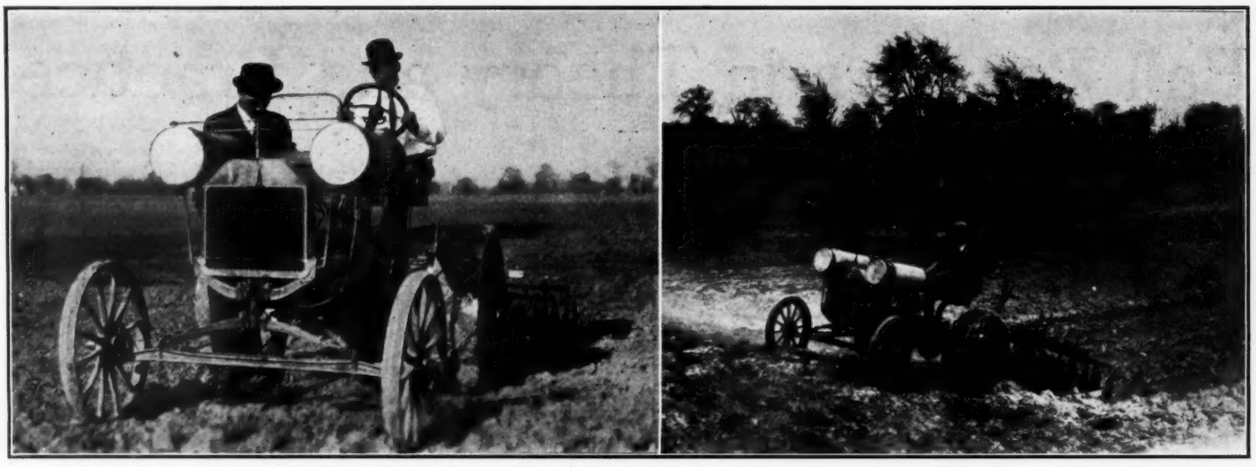
Taking the whole state, 159,715 cars have been registered this year, as against 99,849 last season. The total number of chauffeurs registered is 57,462, as against 47,262 last year, while there are 1,795 dealers registered, as against 1,394 in 1914.

The total fees collected from automobilists amount to $1,251,572, as against $954,714 collected in 1914.

Ohio Cars and Trucks Number 120,500

COLUMBUS, O., May 8—According to a statement issued by Ohio Registrar of Automobiles, W. H. Walker, covering the period from January 1 to April 15, automobiles, including trucks, to the number of 120,500 have been registered. This is almost as many as was registered during the entire year 1914, which number was 122,504.

Chauffeurs to the number of 9,535 have been registered. It is expected that there will not be as large increase in chauffeurs' licenses proportionately as in the number of motor cars.



Two views showing the new Ford farm tractor in actual operation. It is planned to manufacture this machine to sell for $200

Ford Farm Tractor for $200

Will Be Able To Do Work of Six Horses—Said To Have Proved Satisfactory Under Severe Tests

DETROIT, MICH., May 11—The Ford Motor Co. will place on the market next fall a motor tractor for farm usage which it hopes to list at $200. It may be a little more, but the company expects that it will be $200.

During the last 3 or 4 months severe tests were made in a secluded spot with the first tractor and these trials gave the utmost satisfaction to the officials. The tests were made under all kinds of soil and weather conditions, in hard ground and deep mud. Just as with the Ford passenger cars, the principal aim of the company was to bring out a tractor, the price of which would be within the reach of almost any man of moderate means.

Similar to Passenger Car in Appearance

All the details are not yet available, but the tractor will have much of the familiar Ford car appearance. It will have the same motor, front axle and radiator, but a much stronger and shorter frame. Above the motor, supported by strong arms will be carried two large water tanks. The rear wheels will be 12 inches wide and with flanges and spikes padded. The weight now is 1,600 pounds but it is expected that this will be reduced to 1,500 pounds. The tractor will be able to do easily the work of six horses, and it is expected that it will revolutionize farming methods, just as the passenger car has so changed traveling on the road.

Well Along on Production

Within the next 2 months and 26 days the Ford Motor Co. need only build 89,567 cars in order to make good its schedule of 300,000 within the fiscal year ending August 1. This, because up to May fifth and since beginning of last August there have been made and shipped 210,433 Fords. Officials say that the scheduled output will be completed by July 1 and that it is quite likely that when the fiscal year ends very nearly or even a little more than 350,000 cars will have been made.

Ford Leads in Bay State Registration

BOSTON, MASS., May 8—The registration of motor cars in Massachusetts for the first quarter of 1915 shows the Ford to be the big leader again this year, with 10,362 machines listed. It has three times as many as its nearest rival, the Buick, which shows 3,134. The Cadillac looms up third with 2,709. The Packard is the first of the higher priced cars listed with 1,951. Then comes the Overland in fifth place with 1,775. The Studebaker is a good sixth, having 1,389. For a car that has been on the Massachusetts market but a few years, the Hudson has done remarkably well and is seventh with 1,328. The Chalmers is in eighth place with 1,160, and the Pierce-Arrow stands ninth with 1,078. The latter ranks second in the high-priced class. These nine are the only ones that rank above the 1,000 mark. The Maxwell is tenth with 945. In the first twenty-five makes registered those listed after the Maxwell comprise the following in this order: Stevens Duryea, 832; Reo, 776; White, 589; Pope Hartford, 573; Metz, 544; Peerless, 529; Oakland, 512; Jeffery, 494; Franklin, 445; Hupmobile, 413; Winton, 343; Knox, 338; Autocar, 327; Stanley, 296; Jackson, 287; Stearns, 283. Last year during the first few months the leading ten makes were in this order: Ford, Cadillac, Buick, Packard, Pierce, Chalmers, Stevens, Studebaker, Overland, Hudson.

NEW YORK CITY, May 8—The 600 employes of the Robert E. Dietz Co., manufacturer of lamps, are remembered in the will of Frederick Dietz, president of the company who died on March 31, this year. The bequests to the employes are arranged according to their length of service. About 300, who worked for the company for less than 5 years, receive $25. Some of the beneficiaries work in the Syracuse factory and others in the New York establishment.

Ball Bearings in Theory and Practice*

Part I

Modern Methods Produce Balls Accurate to .0001-Inch—Practical Formulae for Calculating Carrying Capacity of Radial Bearings

By B. D. Gray,
Vice-President and Manager of the Hess-Bright Mfg. Co.

THE anti-friction qualities of ball bearings have long been known. Until recent years, however, the ball bearings actually devised have been unreliable. While they lasted, they ran well, but they broke down too easily, the principal reasons being: faulty design; the use of steels insufficiently hard and not uniform; and inaccuracies of size and form, which resulted in unequal loading of the balls and the consequent destruction of those overloaded.

Very little reliable information of value on ball bearings is to be found in the usual engineering and textbooks even today. Seventeen years ago there was little of any kind extant. About that time, 1898, Professor Stribeck, the well-known head of the technical laboratories at Neubabelsberg, near Berlin, was commissioned by one of Germany's leading industrial establishments, to make an investigation of sliding, roller and ball bearings. Having taken up the manufacture of balls and ball bearings, this firm, the German Small Arms and Ammunition Works, (the DWF) Berlin, very soon felt the imperative need for a scientific basis, if the manufacture were to be removed from the domain of haphazard, blind working, resulting one time in success and another time in failure—one quite as much the result of pure chance as the other.

With characteristic thoroughness, Stribeck began with first principles, starting from the investigations of such authorities as Hertz and Auerbach on the deformation of elastic bodies.† Exhaustive tests served to fix the physical constants of the steels that might be suitable. Then followed a series of investigations into the conditions of correct relative motion of the bearing elements. Finally a long and patiently conducted series of observations of many types and sizes of bearings rounded out the whole. Various tentative designs were thus tested out at every point and, more important, practical working data for the use of the designer and the engineer were authoritatively obtained. As a result, the following requirements which form the basis of Hess-Bright ball bearing construction were formulated.

1. Annular rather than cup-and-cone design for radial loads.
2. Use of alloy steels of much more than ordinary toughness and hardness.
3. Microscopic accuracy of size and form, down to a small fraction of a thousandth of an inch, in order that each ball may bear its share of load.
4. Uniform hardness from surface to center of both balls and races.
5. A mirror-like polish as a final touch to perfectly ground surfaces.

Difficult as the production of a perfect ball is under ordinary shop conditions, specialists can now manufacture balls that are true spheres to within one ten-thousandth part of an inch, at relatively small cost. This led to numerous attempts to employ a series of rows of balls instead of rollers, in none of which was proper provision made for taking care of the deflection of the shaft and box under load. After an endless number of expedients to provide for proper load distribution had been tried without success, the simple plan of using a single row of balls and that of suitable proportion for the load was adopted. This resulted in a journal having no appreciable length and accordingly free from trouble caused by deflection. (Hess-Bright annular bearings will permit tilting the inner race, with respect to the outer race, approximately 1-8 inch to 1-4 inch in 12 inches, this being dependent upon ball size, groove radius, and clearance between ball and grooves.) The problem was then to proportion the diameter and the number of balls to the load to be carried. As the number of balls in a single circle was necessarily limited and as the journal diameter could not be indefinitely increased, it became important to develop the carrying capacities as affected by the shape of the ball tracks and the nature of the materials. The necessary design data were found to exist in the observation and experiments conducted by Stribeck.

It was found that the frictional resistance was least for balls rolling between straight line sections, or perfectly flat surfaces, giving two points of contact. Increasing the points of contact to three and four produced higher frictional resistance without materially affecting the carrying capacity. Curving the race resulted in an important increase in carrying capacity, with a barely measurable increase in friction. This greater carrying capacity is accounted for by the fact that in a rolling bearing, in the absence of grit, there is no wear as in a sliding bearing, but a destruction by crushing of the surfaces in actual contact. This point in the race, when overloaded, is flaked out. If, in a ball bearing, the race is curved, the stressed particle cannot be flaked or pushed out, being confined and supported by the wedges of material on either side. The resistance to crushing is thus greatly increased by curving the race.

Formula for Carrying Capacity

From his experiments, Stribeck developed the following equation for the carrying capacity of an annular or radial bearing:

$$P = k\ d^2 \frac{n}{5}$$ in which

P = carrying capacity of bearing in pounds.

d = ball diameter in eighths of an inch, e. g. 1-2 inch diameter ball, d = 4.

n = number of balls in bearing.

k = a constant dependent upon the material, the shape of the ball supporting surface, and the speed.

This is the commonly accepted equation for determining the carrying capacity of a radial bearing and one much made use of by those exponents of the theory that the carrying

*Note—From a paper read before the Electrical Vehicle Assn., of America, Philadelphia, April 14, 1915.

†See Hertz, on the Contact of Elastic Bodies; also Ball Bearings, a paper by Henry Hess before the A. S. M. E., at Indianapolis, Ind., May, 1907, and contained in Volume 29 of the Transactions, which contains a translation of Professor Stribeck's report.

capacity of a bearing is directly proportional to the number of balls contained. Other things being equal, this would be true, but it must be borne in mind that the race cross section plays a vital part also in determining the carrying capacity of a bearing. Any device that may be employed for the insertion of a larger number of balls than can be gotten into the bearing by eccentric displacement, such as filling slots, making one side of the race groove shallow, etc., weakens the race and hence results in a decreased carrying capacity. A bearing with continuous rings, deep ball grooves, and as many balls as can be inserted without forcing, makes the best bearing. These stiff rings are susceptible of extreme accuracy of manufacture, and maintained accuracy in service, even though mounted in slightly out of round housings.

A few tests of deep groove bearings and other makes with larger number of balls will, I believe, prove interesting and at the same time bring out clearly the point which I wish to make. In these tests bearings corresponding to D. W. F. No. 308 were tested under a radial load of 2,500 pounds at 1445 r.p.m. The rated steady load carrying capacity of a No. 308 bearing at 1445 r.p.m. is approximately 775 pounds. The radial load of 2,500 pounds was selected in order to bring about quick results, since the number of hours run before failure occurs is all that is needed for comparative purposes, and gives a true indication of the relative endurance of the bearings.

Bearing	Number and Size of Balls	Hours Run Before Failure	Remarks
H.B. No. 6308.....	8 9/16"	186¾ hours	Deep groove type
H.B. No. 6308.....	8 9/16"	176¾ hours	Deep groove type
"A"	13 9/16"	87½ hours	With filling opening
"A"	13 9/16"	79 hours	With filling opening
"B"	8 9/16"	55¼ hours	With filling opening
"B"	8 9/16"	59¾ hours	With filling opening
"C"	11 9/16"	32 hours	With filling opening
"C"	11 9/16"	46¼ hours	With filling opening
"D"	30 7/16"	19½ hours	Two rows of balls
"D"	30 7/16"	26 hours	Two rows of balls
"E"	13 9/16"	47½ hours	Very thin races with filling opening
"E"	13 9/16"	47 hours	Very thin races with filling opening
"F"	12 0.610"	63¾ hours	With filling opening

To assemble balls into a bearing having flat races is simple enough, but when the race is curved some provision must be made for inserting balls in excess of those introduced by eccentric displacement. The obvious thing is to cut a narrow cross channel, known as a side-filling opening. But as the carrying capacity of a ball bearing with uninterrupted race section is greatest, it follows that any opening for the side filling of the balls, which would break such section, would correspondingly locally reduce the capacity. Such an opening would have to be kept on the unloaded side of the bearing, or avoided altogether. Riebe's design, our first development and the predecessor of the present annular ball bearing was of this kind. The balls were introduced through a cut in one race at the side, the continuity of the race being restored by a "filling in piece," Fig. 1. Still the cut constituted a weak point, and a screwhead was utilized to keep this joint at the unloaded side.

Conrad Invented Continuous Race

To Conrad belongs the merit of eliminating the filling opening and providing an annular bearing of continuous race and uninterrupted groove, Fig. 2 and 3. Incidentally, also, all of the troubles due to interference between balls and filling opening edges were done away with. To assemble this bearing, now generally known as Hess-Bright, HB or DWF, the inner race is placed eccentrically with the outer, the balls are filled into the crescent-shaped space between, the races are centered, the balls are distributed and a cage is provided to maintain the proper distribution, to prevent the balls from rubbing against each other, and incidentally forming a unitary device.

The problem of producing a successful ball bearing was not solved with the adoption of the proper cross section and form. It has already been pointed out that truth of shape is necessary to true rolling and the avoidance of sliding. Loading must inevitably cause some distortion and so introduce sliding action. This sliding action must be minimized by using materials sufficiently elastic to avoid permanent deformation. This demands steels of the very highest grade, most carefully hardened, and eliminates all case-hardened materials. These demands made on the ball material are made on the race materials in even higher degree. In time, the entire surface of the ball is presented to the load, vibration or change of load, either in amount or direction, sufficing to frequently bring in a new axis of rotation. As one of the races is usually fixed, it always presents the same point to the action of the load. It may safely be said that only the advent of high-grade alloy steels has made the ball bearing possible as a heavy load-bearing machine element. They are being used with satisfaction in automobiles, electrical, flour, and woodworking machinery, in street railway motors, on street and steam railway main journals, in line shaft hangers, and in countless other applications where power economy and freedom from wear are desired.

Naturally, satisfactory service from a ball bearing can only be secured when the bearing is designed to conform to the service for which it is intended. The elements entering into such design are the direction of the load, whether at right angles (radial) to the shaft, parallel with it (thrust), or acting at an angle. Within each type, sizes are affected by the loads and by the speeds. Bearings are further affected in their relative arrangement by varying combinations of load-direction, load and speed.

Ball Diameter Governs Shock Resistance

Bearings for carrying radial loads are commonly known as radial or annular bearings. Resistance to the shock of a given load is greater, the greater the ball diameter. When shock is present, of two bearings having the same carrying capacity, that having the larger balls should be used. Radial bearings, as commercially manufactured, are made up in three series—light, medium, and heavy weight series.

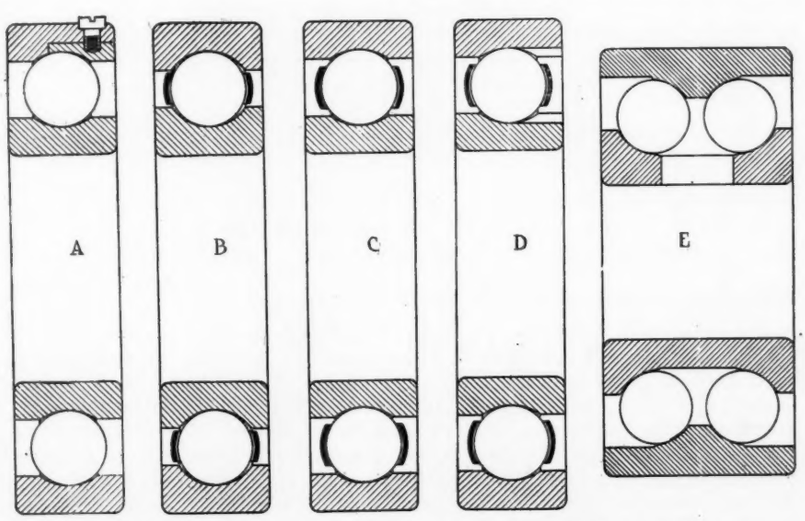


Fig. 1—A—Riebe's ball bearing design. Fig. 2—B—Monarch type of annular bearing. Fig. 3—C—Regular annual bearing design. Fig. 4—D—Side filling opening type. Fig. 5—E—Bright's 2RO annular ball bearing

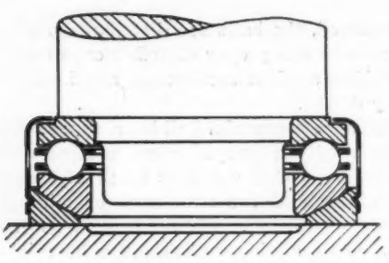


Fig. 6—Thrust bearing with spherical seat.

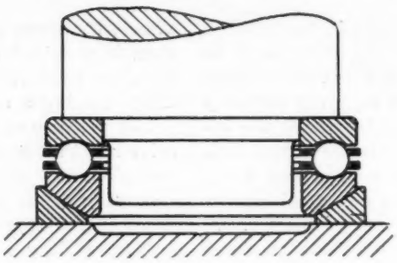


Fig. 7—Thrust bearing with a lining washer.

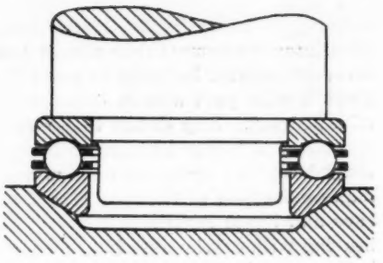


Fig. 8—Thrust bearing with a lining washer and inclosing case

Thus for a given bearing bore, a choice between three sizes of bearings of increasing capacity and ball diameter is afforded.

Bearings for carrying thrust, that is, load parallel to the axis of the shaft, are commonly known as thrust bearings. In these, the ball tracks are arranged in planes at right angles to the shaft axis. To secure the full carrying capacity, the two collars must be in practically absolute parallelism. A deviation of less than .0001-inch will concentrate the entire load on a few balls at one side, overload these and reduce the bearing capacity. To secure exact parallelism between the shoulders on a shaft and the housing seat, even under deflection and the small yet important and unavoidable errors of workmanship, one collar is generally given a spherical surface, Fig. 6, which permits it to adjust itself in its correspondingly cupped seat and thus secure the parallelism required.

Radial bearings are capable of carrying considerable thrust load, amounting in the deep groove or Monarch type to about 25 per cent. of their rated radial capacity. Where it seems desirable to subject radial bearings to thrust load, it is advisable to consult with the bearing manufacturer.

Angular loads may be carried on our 2RO bearing, Fig. 5, or by a suitable combination of radial and thrust bearings, since all angular loads may be resolved into radial and thrust components.

Mention has been made before of the necessity for precision in manufacture, and it may be stated as an axiom in ball bearing manufacture that "the value of a ball bearing is in direct ratio to the accuracy attained in the manufacture of its component parts, and the suitability of the material entering into them." The limits of tolerance are much smaller than are generally considered feasible. The finish of the working surfaces of the balls and races must be of the highest. Grinding or polishing marks that may be detected, by the eye, condemn balls and the ball tracks utterly. Oft-repeated endurance tests under conditions where the finish was the only variable, abundantly proved this, at first unsuspected, fact. The higher the finish, the better the endurance of the bearing. Micro-photographs of ball surfaces reveal that what appears to be an absolutely flawless surface is in reality composed of fine scratches, pittings and even gash-like defects, according to the care devoted to the final operation. Mere polish alone will not do; the polish must be the final touch applied to truly ground shapes.

Balls Must Be of Same Size

The balls must represent as close an approach to true spheres as it is possible to realize. Moreover, all of the balls in a bearing must be closely alike in size, the allowable variation being extremely small. It is evident that a ball larger than its fellows must receive more than its share of the load and therefore transmit a correspondingly greater pressure to the race, resulting in excessive and unsafe loading for both elements. On the other hand, an undersized ball will be underloaded, or not loaded at all; its fellows, having to take its share of the burden, must correspondingly carry more than their proportion. Variations from truth of outline have effects locally similar to size variations. To secure the necessary even division of load, the balls in a bearing may not vary more than .0001-inch from one another and from truth of shape. That this demands the most painstaking accuracy of manufacture and rigid inspection is clear.

To insure interchangeability of the bearings, the bore of the inner race and the outside diameter of the outer race are held to within a few ten-thousandths of standard size, the former being determined by proper plug gauges, the latter by snap gauges. By means of special fixtures, the eccentricity of the inner and outer races can be accurately determined. The eccentricity of the inner race is that lack of running truth noticed upon the stationary outer race when rotating the inner race and balls upon true centers. The eccentricity of the outer race is that lack of running truth shown upon a suitable indicator during the rotation of the outer race and balls upon the inner race fixed upon a stationary arbor.

But not only is accuracy in shape essential; a similarly high degree of precision in the physical characteristics of the steels is quite as essential. While the determination of uniformity of dimension is a matter of accurate measurement by methods highly refined yet familiar to many, the measurement of material quality, particularly of hardened steel, is by no means simple. Very little is, in fact, really known about the qualities of hardened steel. Ask half a dozen men, good mechanics, engineers, metallurgists or scientific investigators, what constitutes hardness, from an absolute standpoint, they will not agree on a definition since hardness is comparative, only. Various methods of determining comparative hardness are used, the two most commonly employed being the Brinell and scleroscope tests.

The Brinell test is founded upon the effect produced on a substance by a known load pressing through a spherical ball into the surface of the material to be tested. The method of working is as follows: The weight or load given in kilograms is generally 3,000 for iron and steel and 500 for softer metals and alloys. The pressure is applied hydraulically by means of an oil pump and is transmitted through the plunger to a hardened steel ball 10 millimeters in diameter, which makes a cup shaped impression on the test piece. From the diameter of this impression, the diameter of the ball and the load a formula has been developed and a table of hardness numerals computed. From this table you can readily read off the Brinell hardness numeral, knowing the load and the diameter of the indentation. This test is not very suitable for hardened rings, since having the same degree of hardness as the ball used, the indentation is small, difficult to measure and likely to introduce error.

In Shore's scleroscope a small cylinder of steel, with a diamond point, inclosed in a glass tube with graduations of arbitrary units, is allowed to fall upon the smooth surface of the material to be tested. The hardness number is the height of the rebound of the hammer. The hammer weighs slightly over 1.5 grammes. The height of the rebound from hardened steel is in the neighborhood of 100 on the scale, or about 180 millimeters, while the total fall is about 10 inches, or 254 millimeters.

After all, the final test is the finished bearing. At frequent intervals completed bearings from regular lots passing through the shops are subjected to tests for load capacity and for endurance by running them under various conditions of load and speed in special testing machines built for this purpose.

Ball bearings do not differ from other elements of mechanism, in that they must be used in conformity with their individual characteristics. Directions for correct mounting that are hereafter cited must be absolutely adhered to under penalty of failure.

A strict adherence to all of the directions, and they are neither many nor troublesome, will result in a reliability as near to absolute as even the most exacting can expect, a reliability far beyond that of any other form of journal, and such reliability is gained with the advantages of a practical absence of friction, small space occupied, and the minimum of attendance. Surely these are advantages enough to make a careful study and following of the directions worth while.

Correct Bearing Care

1—The proper size selection for the load must be made. Rated capacities are usually for steady loads and speeds. Variations from these conditions demand recognition by corresponding variations of the listed capacity.

2—Bearings must be lubricated. The oft repeated statement that ball bearings can be run without lubricant is pernicious.

3—Bearings must be kept free of grit, moisture and acid. This prohibits the use of lubricants that contain or develop free acids. It is entirely practicable, by very simple means, to follow injunctions 2 and 3.

4—The inner race must be always clamped solidly to the shaft, so that no vibration can cause it to turn. This requires that the shaft be ground perfectly true, in order that it may make contact with the race all around, not merely at a few points. Unless this is done, a peening action will start, resulting in looseness. The race itself should be mounted with a light press fit, and very solidly clamped between a nut and shoulder.

Outer Race Must Permit Slow Creeping

5—The outer race must be mounted in such a manner as to permit slow creeping. This has two beneficial effects. First, it avoids any possibility of an undesired endwise cramping of the balls in the race; second, such minute wear as occurs in the ball path is distributed around the entire circumference of the latter. To accomplish these results the housing must be accurately bored to such a diameter that the outer race will be a sucking fit in it, and the race is either left entirely free endwise or is confined between shoulders which give it a slight endwise freedom amounting to 1-64 inch or less. Only one bearing on a shaft may be confined endwise in this manner, since otherwise expansion or errors in machining or workmanship would produce undesirable axial or endwise cramping.

6—The bearing enclosures must retain oil or grease, while excluding dust and water.

Finally, after having observed the above precautions, submit your design to the bearing manufacturer and get the benefit of his experience. By so doing, many little things which you, from your experience may consider of minor importance, but which he, from his broader experience knows are pernicious, may be avoided.

(To Be Continued)

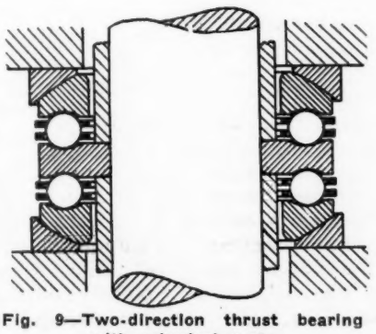


Fig. 9—Two-direction thrust bearing with spherical seats

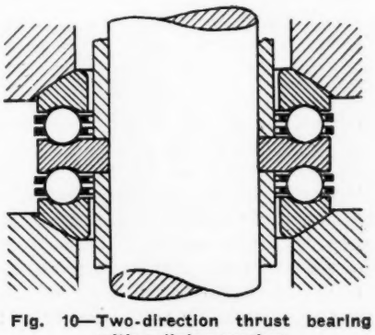


Fig. 10—Two-direction thrust bearing with a lining washer

Record Demand for Tool Steel

By Consul John M. Savage

SHEFFIELD, ENGLAND, April 16—The most striking feature of Sheffield's trade today is the remarkable boom in high-speed steel. In the history of the trade nothing approaching the present demand for this article has heretofore been experienced; in fact, the present colossal requirements have never been dreamed of. Not only are orders numerous, but they are of tremendous size and value. These orders, in addition to British sources, come from Russia, France, Italy, and the United States. One order received this week from Russia amounted to 100 tons. This does not seem a large quantity when speaking of steel to those unfamiliar with the trade, but the importance of the order can be gauged by the fact that this material is quoted by the pound, and the price today is from 1s. 8d. (41 cents) to 4s. (97 cents), as against 1s. 4d. (32 cents) to 3s. 6d. (85 cents) in normal times.

An immense quantity of this steel is necessary in the production of armanents, and every engineering shop in England is busy on this work.

The resources of this city for meeting the increased demand are totally inadequate, many firms having been compelled to refuse orders because of their inability to take on additional business.

In the manufacture of high-speed steel the principal alloys used are tungsten powder or ferrotungsten, ferrochrome, and ferro-vanadium, and the supply of these alloys has failed to a great extent, which has been a further handicap to manufacturers.

High Tungsten Prices to Prevail

Prior to the war it is estimated that Germany supplied 90 per cent. of the tungsten used by British manufacturers, and since then this source of supply has been entirely cut off. British firms are endeavoring to supply this deficiency and expect to be able to place their products on the market by midsummer, although there is no certainty as to this. In any case it is thought the present high prices prevailing will continue throughout the year.

Ferrochrome (4 to 6 carbon) has advanced from 30 to 35 per cent.

The price of vanadium has remained stationary, owing to the fact that almost the entire supply comes from the United States, where there is ample production.

Ferrotungsten has advanced from 2s. 4d. (57 cents) to 4s. (97 cents) per pound of tungsten contained in the alloy.

Tungsten powder (from 96 to 98 per cent. pure) has made the phenomenal advance from 2s. 4d. (57 cents) to 5s. 6d. ($1.34) per pound.

In former times tungsten powder was the favorite form of wolfram used by local manufacturers. Since then, however, owing probably to the difficulty experienced in procuring wolfram in this form, ferrotungsten is being extensively used.

The Rostrum

Oiling System of 1913 Pope-Hartford

EDITOR THE AUTOMOBILE:—Please explain the oiling system and how it should be regulated on a 1913 Pope-Hartford 40-horsepower touring car?

2—Kindly give me a diagram of the wiring of all the Gray & Davis lights, generator and starter, and also kindly explain how I can make the lights brighter.

3—What are the largest size bulbs which I can use in my headlights? It is equipped with a Gray & Davis starter and generator.

Newark, N. J. N. P. HANSON.

—A mechanical oiler M, Fig. 2, is located on the crankcase having a large suction pump and in addition to this a stand pipe which is used as an overflow permitting oil, when it reaches the level of the standpipe, to run back through the standpipe into the crankcase. The bottom half of the crankcase is constructed with an oil reservoir underneath and cast integral with it. The bottom half of the crankcase is provided with a standpipe, fitted with gauze which acts as a strainer, the standpipe maintaining at all times a predetermined level in the crankcase while the surplus flows through the gauze and is strained before it reaches the reservoir. There are two large additional strainers and located at either end of the case to carry off the surplus oil when going either up or down hill. The crankcase is also provided with a copper filling tube N about 1 inch in diameter and fitted with a screw cap on top to provide a means for supplying the crankcase and reservoir with oil. The case is provided with a petcock for use as a gauge when the reservoir is being filled and the reservoir is provided with a petcock in the bottom part which also acts as a gauge to determine if there is a supply of oil in the reservoir.

Filling System with Oil

In supplying the lubricating system with oil, first fill the mechanical oiler M. When this is done the surplus oil will run through the overflow pipe above described, into the crankcase which will leave the proper amount of oil in the oiler. Then remove the cap from the top of the filling tube on the crankcase, previously described, and open the upper petcock, the one in the crankcase already described, and pour oil in the filling tube until it runs out of this cock. This will take in the neighborhood of 3 gallons of oil. The best results can be accomplished by having the car in as nearly a level position as possible when it is being filled with oil and the petcock should be left open until the oil ceases to flow. You will then have the correct amount of oil in the crankcase and the motor is ready to start. In addition to the pumps in the oiler forcing oil to the cylinders a large suction pump sucks oil from the reservoir in the crankcase into the mechanical oiler maintaining a proper quantity of oil, the surplus running through the overflow pipe into the crankcase, whence the surplus oil runs through the strainers to the reservoir, from where it is again pumped up to the oiler, taking care of the lubrication as long as any oil remains in the reservoir or the oiler.

Oil should be added through the filling tube every day, depending upon the number of miles the car is run, always opening the upper petcock to make sure that the proper quantity of oil is supplied and allowing it to remain open until oil stops running. If it is desired at any time to know whether or not it is necessary to replenish the oil in the crankcase, open the bottom petcock; and if no oil comes out of this cock the oil should be replenished at once, as this shows an absence of oil in the reservoir. The car can be driven with safety as long as any oil comes out of this petcock and when the oil is at such a point in the reservoir that it will not run out of this cock the car can still be driven until the mechanical oiler is empty. It is important that the oiler be adjusted to feed so that one drop only at a time will show in sight feeds to each cylinder.

The supply is regulated by adjustments which are located on top of oiler M, Fig. 2. No. 1, the one nearest the radiator, regulates the oil supply to No. 1 cylinder. No. 2 regulates the oil supply to cylinder No. 2. No. 3 regulates that to cylinder 3. No. 4 governs that to cylinder 3, and No. 4 regulates the supply to cylinder 4. By screwing these up you decrease the supply. Individual feeds are on top of oiler.

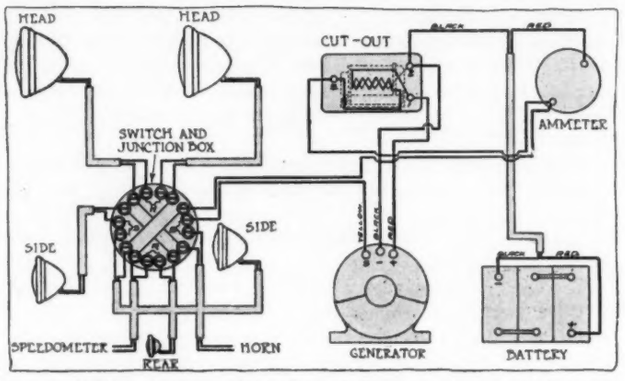


Fig. 1—Wiring diagram of the Gray & Davis system as used on the Pope-Hartford for 1913

2—The Gray & Davis system which was used on some of these cars is illustrated as regards the wiring diagram in Fig. 1. The lamps cannot be made brighter except by using lower voltage ratings, thereby producing a greater glow at the filaments. The trouble with this scheme is, however, that the lamps burn out so rapidly that it does not pay.

3—You should use 6-volt 24-candlepower double-contact bulbs in your headlights.

Fuel Tested at Indianapolis Speedway

Editor THE AUTOMOBILE:—I have noted in several back issues of THE AUTOMOBILE articles in regard to a new fuel that was being tested by a man from Pennsylvania and which was also tested at Indianapolis Motor Speedway. I understood that there was a company formed to manufacture this new fuel but have not been able to find out any more about it. Has the new fuel proven a failure or is the company preparing to market it?

Troy, O. W. M.

—You are probably referring to Zoline which was tried out at the Speedway at Indianapolis but which was found to be a more expensive product to manufacture than gasoline. For this reason it was abandoned.

Using the Motor as a Brake

Editor THE AUTOMOBILE:—What effect does the practice of using the motor as a brake coming down a hill have on the mechanism of an automobile?

2—Which is the more economical, that is to use the above method and save gasoline and brake bands, or to use the

service brake in order to save the mechanism of the car?

Johnstown, Pa. H. H. M.

—The use of the motor as a brake is generally conceded to have a more or less deleterious effect on the gears. The power through the gears is reversed since the car is now tending to drive the motor. Thus instead of having the step-down reduction we have a step-up with consequently more surface pressure on the teeth and hence more abrasion.

2—It would not seem, in view of the above, to be the correct thing to do to habitually use the motor as a brake. It is better by far to use the brake in the way in which they are intended. One should not abuse even the service brakes but should always endeavor to bring the car to a gradual rest with as little use of the brakes as possible.

Apple Used Timed Dynamo in 1909

Editor THE AUTOMOBILE:—Do you or any of your readers recall an Apple ignition system which was brought out in 1910 or 1911 in which a shunt-wound dynamo was employed with a storage battery floating on the line, and an igniter contrivance driven in timed relation to the engine?

Cambridge, Mass. AUTO WIND SHIELD CO.

—The Apple Electric Co. made and installed quite a number of shunt-wound dynamos driven in timed relation to the engine in the years 1909 and 1910. Some of these installations had the timer and distributer drive, but as this was ahead of the dual magneto development, the engines were then built with the timer drive as regular equipment.

Speed of Regal Motor at Car Rates

Editor THE AUTOMOBILE:—What is the engine speed of Model N 1911 Regal roadster at 15 miles on high gear?

2—At 20 miles, at 25 miles and at 30 miles?

3—What is the gear ratio of a model N 1911 Regal on high?

4—What is the gear ratio of a five-passenger Cadillac, 1912, on high?

Oshkosh, Wis. L. W. HOLLISTER.

—With a rear axle ratio of 4 to 1, and 32-inch wheels at a car speed of 15 miles per hour the engine will be turning over 840 r.p.m.

2—At 20 miles per hour the engine speed would be 1,050 r.p.m. and at 30 miles per hour it would be 1,470 r.p.m.

3—The gear ratio is 4 to 1.

4—The gear ratio on many of these cars is 3.5 to 1.

Vibration at High Rotative Speeds

Editor THE AUTOMOBILE:—Can you tell me what might cause excessive vibration in a 1911 Reo? This starts at about 30 miles per hour?

The main and connecting-rod bearings have been tightened. There are new bearings on camshaft; new camshaft gears which take up play in timing gears, and the valves and magneto are timed correctly. There are two new rings on each piston with new wristpins. The flywheel has been tested for looseness and found to be tight. The motor is bolted securely to the subframe. The subframe rivets near the rear end of motor were found to be loose, were taken out and replaced by bolts. The bolts are perfectly tight now but will be replaced by rivets at the first opportunity.

GEO. A. WILKINS.

Taunton, Mass.

—As a general rule vibration is due to the initial design of a motor. The probabilities are that if the gear ratio was less so that the motor did not have to run at such a high rotative speed, you would not be troubled by the vibration at 30 miles per hour. The difficulty then, would be that you would not be able to negotiate hills as well on high gear.

There does not seem to be any cure for your trouble unless you go to the expense of fitting a lighter set of pistons and connecting-rods. These would have to be very carefully balanced. It might also be that the crankshaft is not in proper running balance, resulting in whipping and distortion at high speed which, in turn, causes excessive vibration. If this is the case, the difficulties which you will encounter in trying to remedy the trouble are much greater, since it will entail the re-designing of the crankshaft.

Spokes Guaranteed for 3 Years

Editor THE AUTOMOBILE:—How often must the spokes of wire wheels be adjusted? Do road shocks loosen the enamel so that they must be re-enameled at intervals?

2—Has the M. & S. differential been very widely adopted by manufacturers? Is this differential any heavier than the ordinary type? Would such a differential be advisable on passenger cars?

Beaver Falls, Pa. E. S.

—Wire wheels are generally guaranteed 3 years against the spokes coming loose or the wheels coming out of true. Wire wheel companies do not believe in their customers attempting to adjust their own spokes as a general rule, in fact some of the companies state that the wheel is guaranteed provided the spokes are never adjusted by the user.

Road shocks should not loosen the enamel any more than it should the paint or varnish on wood. The only reason for re-varnishing being when it is scraped off through rough service.

2—The M. & S. differential has been adopted so far by one truck concern and there are said to be other concerns which are negotiating for its use.

Magneto Can Run Anti-Clockwise

Editor THE AUTOMOBILE:—Will you kindly inform me whether a high-tension magneto that runs at crankshaft speed and rotates clockwise, can be timed or changed to rotate opposite or anti-clockwise, and if so, kindly show a diagram or drawing if necessary of how to make the change.

Lee, Mass. W. K. W.

—The magneto referred to can be changed to run anti-clockwise by simply removing the gears from the distributer and resetting them so as to carry the current over the points of contact throughout the full range of spark advance at full retard and at full advance. Simply take the gears out of

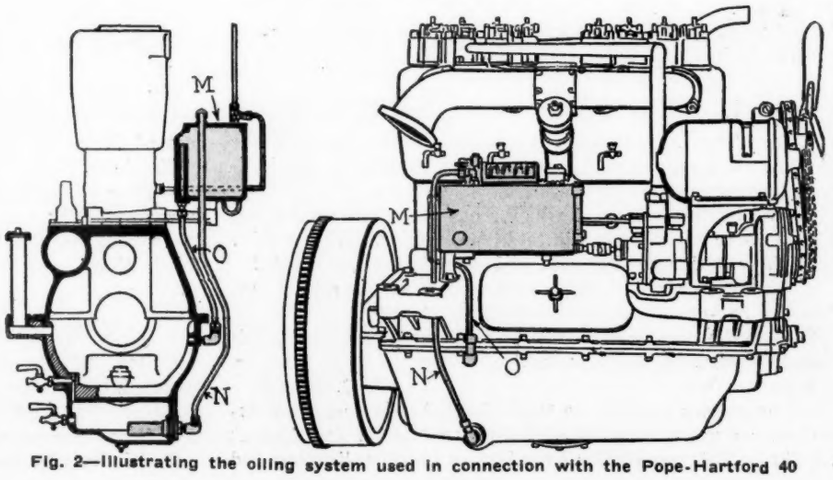


Fig. 2—Illustrating the oiling system used in connection with the Pope-Hartford 40

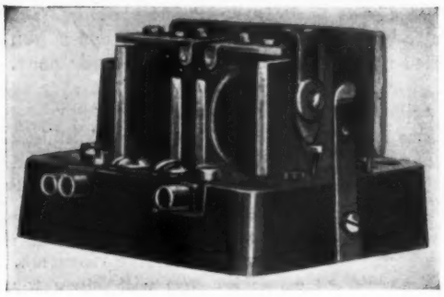


Fig. 3—Tirrel regulator for Remy system

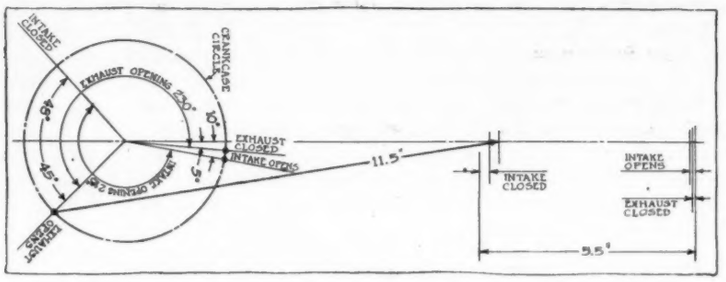


Fig. 4—Diagram showing the valve timing of Pierce-Arrow model 38-C

the distributer, revolving the armature by hand in an anticlockwise direction and when the position in which the armature turns requires a good deal of force to continue the turning, due to the pull of the magneto, insert the gear in the distributer so that it is just coming into the metal contact. If the model magneto referred to has a roller-type distributer, the same operation holds good except that the roller with the internal gear should be set so that the contacts are just meeting the small metal roller.

Bad Adjustment Causes Noise in Gears

Editor THE AUTOMOBILE:—Have a 1914 model Chevrolet Royal Mail. At low speeds there is a grinding sound in the rear axle, seemingly caused by the gears. How can this be remedied?

Baltimore, Md. A SUBSCRIBER.

—The cause is probably a poor adjustment between the bevel drive pinion and the crown gear and this can be remedied by simply adjusting the mesh between these gears. This adjustment can be made by removing the small hand hold plate located at the rear end of the propeller shaft housing and by turning a screw adjustment on the inside to the right or left to secure a tighter or looser adjustment of the bevel pinion as desired.

Six-Passenger Chandler Special Design

Editor THE AUTOMOBILE:—In THE AUTOMOBILE for April 8, I notice a cut of a six-passenger roadster body with the statement that this is now being built for a Chandler six chassis.

Will you kindly tell me whether or not the Chandler company is putting this out as a standard roadster type, or whether the body is specially built; and if so, the name and address of the builder?

Chicago, Ill. R. H. RIPLEY.

—The body referred to is a special job put out by the Brady-Murray Motors Corp., the New York agent for the Chandler company. It is not a stock body but is made to special design.

Why Pierce-Arrow Does Not Race

Editor THE AUTOMOBILE:—Will you please describe the 1915 Pierce-Arrow motor, showing and explaining the ignition, lighting and starting system.

2—Of the different races which I have seen and read about I have never noticed any Pierce-Arrow entries. Why is this?

3—How is this motor timed and what is the gear ratio?

4—Is there an automobile company putting out a 1915 car, four- or five-passenger torpedo body as stock?

5—Are there to be any free-for-all races in Michigan, Illinois or Wisconsin, this summer?

Waupun, Wis. J. B. BRIGGS.

—The motors used in the 1915 Pierce-Arrow cars were described on pages 300-303 of THE AUTOMOBILE for August 13, 1914. This description explains the ignition, lighting and starting system. It would take too much space to cover the matter here.

2—The Pierce company has never gone in for racing, but has devoted its attention to legitimate road contests, such as the Glidden tour and the Herkimer tour in Europe, considering such tests of more importance to the buyer of a touring car than the success of the special racing car, in all probability entirely different from the standard product. The company considers it a waste of time for manufacturers to enter such contests, although if races were won by a standard car of the type the public desires, it would be different.

3—The valve timing of the Pierce-Arrow 1915, 38-horsepower model is shown in Fig. 4. The standard gear ratio for the five-passenger model is 3.78 to 1.

4—There are a number of companies putting out stock 1915 models with four- or five-passenger bodies which they describe as torepdo. As a matter of fact, it has never been very clearly defined exactly what constitutes a torpedo body.

5—The Contest Board of the American Automobile Assn., New York City, has advised us that it will send you a list of free-for-all races to be held in Michigan, Illinois and Wisconsin this summer.

Warner Gears Were Fitted to Peugeot

Editor THE AUTOMOBILE:—If I understand correctly, the Peugeot car which won the Vanderbilt Cup and Grand Prix races was of foreign make throughout. Were there any gears used in the differential made by the Warner Gear Co., Muncie, Ind.? ROBT. M. COX.

Highland Park, Mich.

—The driving gears used on the rear axle of Dario Resta's Peugeot car which won the Vanderbilt and Grand Prix races were made by the Warner Gear Co., Muncie, Ind. This company made up a special set of gears with a higher ratio for the purpose of obtaining a greater speed.

Cord Tires Use Continuous Cords

Editor THE AUTOMOBILE:—Will you kindly define a cord tire?

My understanding is that it is a tire in which one or more continuous cords are used in place of woven fabric, regardless of the maker's name. Is this correct?

Charlotte, N. C. D. H. HOWARD.

—Your understanding of the construction of the cord tire is correct. The name of the maker of the tire has nothing to do with its classification under the head of cord tires or fabric tires.

Can Connect Ammeter to Old Wires

Editor THE AUTOMOBILE:—Can I install an ammeter which registers both charge and discharge; thirty points both ways, in place of the indicator? If this can be done, shall I connect it to same wires?

2—Kindly give me a diagram of the wiring of the Disco

system which has a generator, motor and automatic cutout on the 1914 Paige 25?

New Brunswick, N. J. J. C. HUNT.

—The thirty-point ammeter can be installed on the wires of the indicator which you have on your car at present.

2—Referring to Fig. 5 the wiring diagram of the Disco starting and lighting system as fitted to Paige cars is given.

Two Methods of Remy Current Regulation

Editor THE AUTOMOBILE:—What can you tell me of the Remy lighting generator, past and present? I am interested in just one point and that is current regulation.

2—What prevents the Ford magneto generator from burning lights out with excessive voltage, at high speeds?

3—What method of current regulation is used on the Esterline?

Weymouth, Mass. H. R. BARKER.

—The Remy Electric Co. has made a great many different sizes and types of generators, all of which, however, have been regulated by either the third brush method of regulation or by a Tirrel regulator.

The third brush method of regulation, Fig. 6, takes advantage of the fact that the magnetic flux of the generator becomes distorted at high speeds and bunches, or gathers, upon the sides of the pole piece faces. A third or pilot brush, which supplies current to the generator field winding, is located upon the commutator in such a manner that when this distortion of the magnetic flux occurs, it reduces the current which is supplied to the field winding. This reduction of the field current naturally causes a reduction of the generator output and prevents it from attaining a harmful voltage.

The Tirrel regulator, Fig. 3, with which many of the generators are equipped consists of a frame with a coil wound upon it thus forming an electro-magnet, a vibrating arm pivoted upon highly polished field pivots and platinum or silver contact points.

The wiring is arranged in such a manner that the generator field current passes directly across these points at low speed. As soon, however, as the speed of the generator tends to cause its output to rise above the predetermined maximum, the electro-magnet coil of the regulator is energized to such an extent that it holds the vibrating arm down, thus pulling apart the two contact points. As soon as this happens, the generator field current which has heretofore been passing through these points, is forced to pass through a resistance and is thus decreased in strength.

This reduction of the field current naturally causes a reduction of the generator output, which, in turn, reduces the energizing effect of the electro-magnet coil, permitting a spring to force the vibrating arm up, thus bringing the contact points together again. A continuous repetition of this action sends a pulsating current to the generator field and prevents the output of the generator from attaining a harmful value.

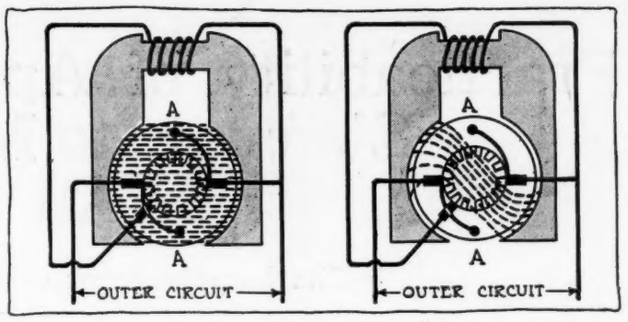


Fig. 6—Diagram showing the third brush system of regulation as used on the Remy system

2—The lamps for the Ford cars are designed to be strong enough to withstand the increases and decreases in current pressure.

3—In controlling the current of the Esterline generator, use is made of a combined electro-magnet and permanent magnetic field. At slow speeds these operate together increasing the current but at the higher speeds they oppose each other more and more thus holding the output constant.

Explains Backfire in Acetylene Welding Torch

Editor THE AUTOMOBILE:—In a recent issue of your paper, a correspondent from Somerville inquires the cause of his oxy-acetylene welding torch flashing back into the mixing chamber and asking what metal he may use to prevent this.

The cause is in the mixture or rather the speed of the mixture, and not the metal. It is a well known fact that unless the mixed gases (oxygen and acetylene) are carried forward at a certain speed, the flame will propagate backwards, that is against the flow of the gases. Unless the torch your correspondent has made is designed to prevent it, such a flashback may become dangerous if the flame is carried as far back as the acetylene tank.

Careful manufacturers of welding apparatus, who keep modern in their ideas, today make a torch which is practically free from flashbacks with ordinary use and such a torch can be purchased for less than the time is worth in making an imperfect, dangerous one.

Boston, Mass. M. KEITH DUNHAM.

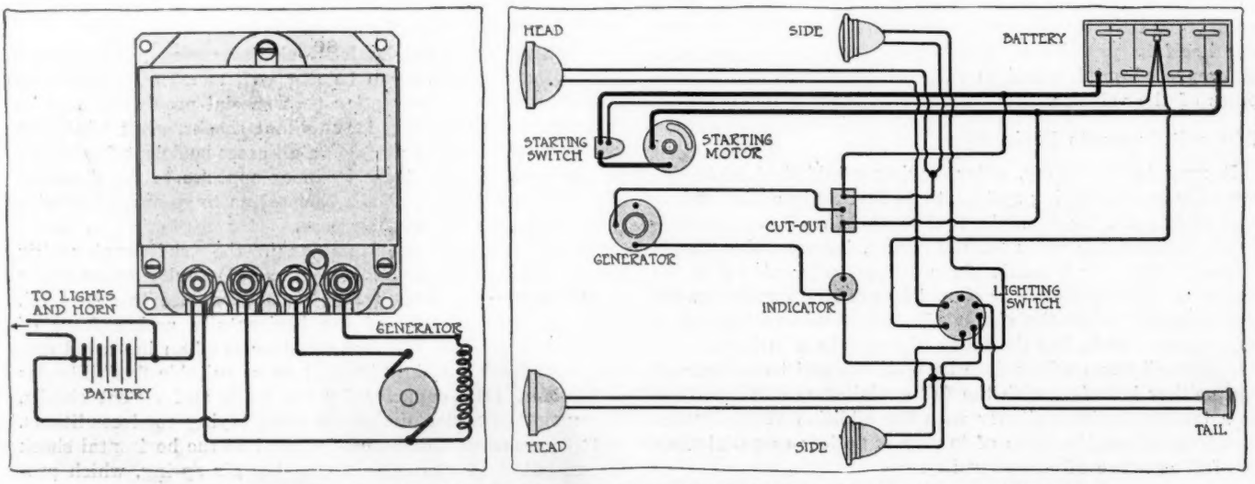


Fig. 5—Wiring diagram of the Disco system as used on the Paige cars, showing the complete system

Practicability of Applying Same Spring Elements to Motor Vehicles of All Classes

(The Improvement of Spring Systems—XIII)

By M. C. K.

WHETHER a standardization of the spring system for motor vehicles can be or ought to be undertaken with reference to its efficiency for security and comfort (rather than with reference to the dimensions of blades, clips and shackles and other details bearing almost solely upon the facilities for production), may be held to be doubtful, since it is always true that there is no magic open sesame to success in such words as "standardization" or "efficiency," which are bound to be interpreted differently by persons of different ability and judgment. To standardize poorly may impede progress as much as to standardize judiciously may advance it. And, to go further, it may even be quite rationally denied that rapid mechanical improvement presents any real advantage over slow progress to either the broad public or the automobile industry. The philosophy of moving very deliberately in industrial matters is perhaps unassailable and at all events is strong enough to prevent any undue haste, even if the advancement involved in standardization of the spring system were proved conclusively. Fear of upsetting the established order of things does not therefore restrain the writer from attempting to show a little more definitely, at some points, than in the previous article on the same subject (in the issue of April 29), that the possibility for a profitable standardization of the spring system does exist.

Suitable spring suspension for each and every type of motor vehicle would be a worthier aim than SIMILAR spring suspension for all motor vehicles, it has been said by an objector, and it would be true if one could not have both aims at the same time. In point of logic the two objectives should be in the same line of view, so far as the essentials in a spring system are concerned. Standardized spring essentials should be as the sight at the muzzle of a gun by which the final consummation of the best possible suspension for every individual vehicle can most readily be brought in line with the efforts for improvement. The relations are those between fundamentals and refinements, any standardization which goes beyond the fundamentals in matters of design defeating itself in practice by running contrary to a legitimate difference of opinion and to rational differences in the purposes of the vehicles.

Where Refinements Begin

It may be necessary, after having established a fundamentally correct spring system, to go farther in an individual case and insist, for example, that the load must be well centered between the axles longitudinally, between the wheels laterally and near the axle plane altitudinally; also that the weight of the running-gear should be minimum and that the tires should "drink the obstacle." But fundamentally it is more important to find the rough elements in a spring system which in all cases will reduce both shocks and bouncing and will neither interfere with the full exploitation of the vehicle as a transportation unit nor with the addition of special refinements where the acme of luxury is no less essential than the full measure of simple utility.

Some refinements, such as that of light running-gears, have only a conditional value. Important for a light car with very flexible springs and highly resilient tires, it becomes relatively unimportant and also impracticable for the different conditions prevailing in the case of heavy vehicles with springs under high tension from the static load alone and with tires that give but weakly resilient response to those secondary impacts of a road shock which are caused by the extension of the vehicle springs. Such a refinement therefore does not belong in a standardized spring system, but should not be excluded by it where needed and practicable. The same consideration holds good for the centering of loads. Of great importance for light cars it yields completely to the practical necessity for load distribution in utility vehicles, and the system which bids for standardization must take care of either branch of design by means of suitable modifications. The smaller the modifications need to be to meet the special requirements in all cases the better is apparently the basis provided for improvement. With this explanation of the aim in view, a standardized spring system may be defined as one by which few and simple elements can be combined to meet all the principal requirements for all kinds of motor vehicles with few variations in the shape, dimensions and materials of each element.

Indispensable Elements

In the previous article the elements mentioned as suitable for such a system were (1) a leaf spring, which may be either a half-elliptic or a quarter-elliptic or cantilever spring (C-springs and platform springs becoming apparently superfluous, while remaining available), (2) an air spring acting in conjunction with the leaf spring, IF NECESSARY, and (3) a device always affording a positive check for spring extension while having an adjustment permitting the damping of the entire rebound stroke in any desired degree and also adapted for absorbing lateral shocks and for resisting rolling and pitching of the vehicle body.

By these TWO OR THREE elements alone, it was contended, all conditions can be met well enough, in the sense explained, with the exception that special provisions may be desirable for cushioning longitudinal shocks. But while the two or three elements are not in all cases sufficient for taking proper care of violent shocks in or opposite to the direction of vehicle motion, they lend themselves to co-operation with other measures for that purpose.

As the principal shortcomings in the traditional spring system are (1) small range of action, (2) faulty action under special road conditions (potholes, sudden rise to new level, etc.) and (3) neglect of the horizontally acting force of shocks, it is evident that the advantages of an improved system must be felt mainly in (1a) more suitable flexibility for underloads, (1b) capacity for overloads and violent shocks, (2) smoother action under the most trying road conditions, and (3) a measure of protection against the horizontal shock forces, but it is also evident that the air spring, which pro-

vides the larger range of action, may be dispensed with if the dimensions of the leaf springs and the working conditions justify the omission, although its retention even under these circumstances will always mean a better protection against the unexpected and great freedom in selecting leaf spring dimensions. As air tires serve to enlarge the range of action of the ordinary spring suspension in all three directions—vertically, laterally and longitudinally—it is further evident that the improved system becomes more necessary when air tires are not used.

It may be explained briefly why the improved system as outlined in the previous article meets the requirements.

The Action Obtained

Cantilever springs being mounted obliquely, the frame-end being higher than the axle-end, also operate obliquely and therefore cushion both the horizontal and the vertical forces in the majority of shocks. The comfort they give, as usually applied, depends mostly upon this quality, even though they also oscillate more slowly than a half-elliptic spring of the same flexibility, and this feature of superior comfort is emphasized by mounting them with a yielding fulcrum. In combination with air tires, as well as with the air spring and the rebound check, they should meet the conditions for nearly all pleasure vehicles, since sharp horizontal shocks are exceptional and make a strong impression on an air tire even if it is strongly inflated, WHILE THE AIR SPRING ADDS RANGE AND EFFICACY TO THE OBLIQUE SPRING STROKE in a manner and degree that cannot be imitated with an ordinary cantilever spring without making it too long and heavy and too slow for its lighter work.

The half-elliptic can also be given a slant—as is done in a great many horse-drawn vehicles, though perhaps most frequently in platform springs—or, if a stronger horizontal spring action is needed, elastic driving-struts can be used with them (in the special manner equalizing the action on both sides of the vehicle, as referred to in other articles), as there is nothing in the relations of the half-elliptic spring to the air spring which would not permit a limited horizontal displacement of the half-elliptics, these being shackled both in front and rear.

Composite Wheels

For the heavy vehicles, however, for which air tires have not been found practicable, so far, the three elements are not quite all that is wanted, as here the horizontal shocks set up

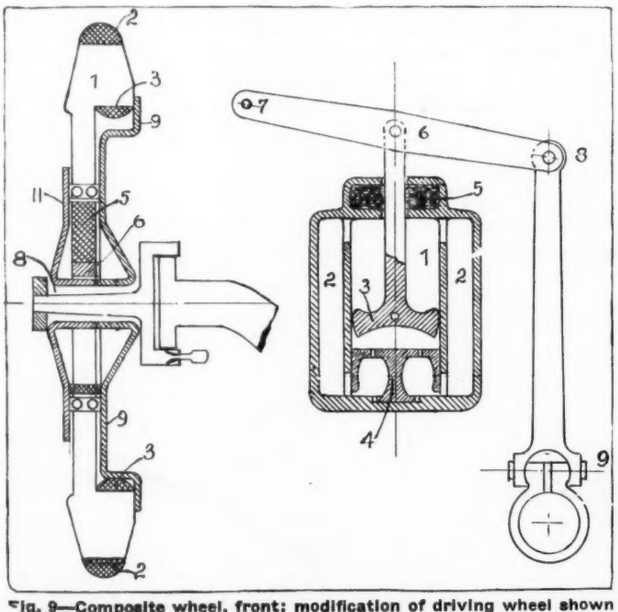


Fig. 9—Composite wheel, front; modification of driving wheel shown in Fig. 8. Fig. 10—Modification of "Bobcheck" shown in Fig. 7

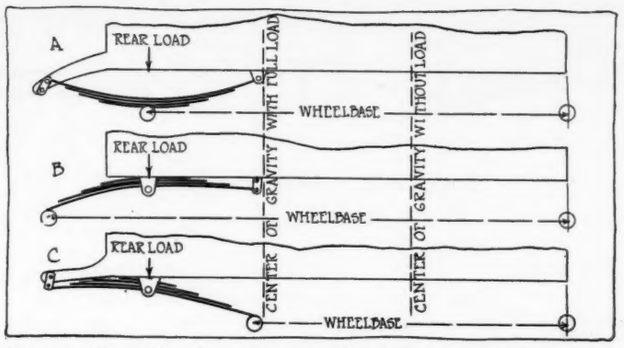


Fig. 11—Illustrating influence of spring type on wheelbase, when load distribution is given

a great deal of harmful vibration in addition to the brute force of impacts. Such wheels as the Sewell wheels no doubt intercept much of the vibration where they can be used, and the air spring in connection with the slant of cantilever springs or of half-elliptics—considering also, again, the large range of gradually stiffening spring action which can be obtained by this combination—should improve the springing for horizontal as well as for vertical forces materially, as compared with present practice, but an improvement going still farther in the way of parrying the more violent impacts may be desirable and would at all events tend to increase the permissible speed where this must now be held down to a maximum of 8 to 10 miles per hour. A special wheel construction was therefore outlined in article XII as the fourth element in the standardization system, as applied to the heaviest class of vehicles, and might perhaps be adapted also to medium heavy vehicles, including omnibuses and 3-ton and 4-ton trucks. The construction previously shown in Fig. 8, in the issue of April 29, could be modified and lightened somewhat on the lines shown in Fig. 9 herewith, the special advantages for securing traction on all sorts of road surface and for starting with heavy loads remaining the same in both cases. In this lighter type there is 1 instead of 2 traction tires, the eccentricity is minimum and a flange on the driving wheel closes the crescent-shaped gap between it and the traction tire.

With this fourth element—the special wheel for heavy vehicles—the standardization system should, then, be nearly complete; in so much more as the short lengths in which cantilever springs can be used in connection with an air spring without surrendering the desirable range of action are practicable for heavy loads, for which springs of this class have not been used so far, and as the half-elliptics fortified by air springs also have a free action which in the heavy vehicle class cannot be obtained by using only half-elliptics or platform springs designed for the same load and shock capacity, as these would become far too long.

Practicability of Each Element

In addition to completeness, practical adequacy must also be demanded of such a system, and in fact this demand ranks ahead of that for completeness. The question is then if each of the elements can be made to do its work properly and can be installed in a vehicle conveniently and without interference with other design requirements.

Very Robust Bobcheck

The construction of the device performing the two functions of checking, under all circumstances, all extension of the spring elements beyond their static rest-position under load and of damping spring oscillation when this may be required, by retarding the whole rebound stroke, speaks in this respect for itself, one of the mechanical forms in which it can be materialized being shown in Fig. 7 of article XII. To distinguish it, in any of the forms in which its principle

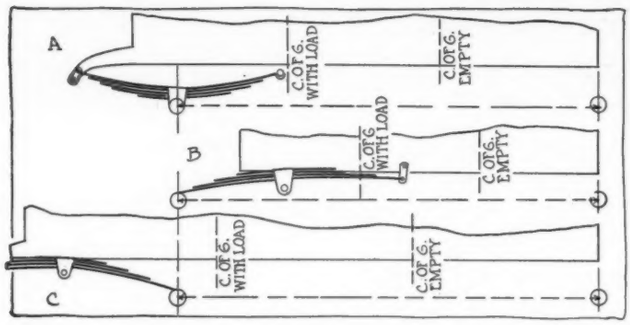


Fig. 12—Illustrating influence of spring type on vehicle frame and body, for a given wheelbase

may be embodied, from devices of similar external shape, the writer designates this device as "bobcheck," as one of its principal effects is to prevent the vehicle body from bobbing up and down needlessly after a shock has been received and has been toned down through the first compression of the spring elements, all subsequent movements being superfluous for this purpose, if they can be avoided. As this device at times must do very severe work in arresting the rebound and preventing all excessive separation of vehicle body and running-gear, it is conceived as made in very robust dimensions, but, on the other hand, no special accuracy in the workmanship is required, excepting that the fit of the shaft in its bearings should be close to avoid the need of packings, notwithstanding that the working pressures do not reach this bearing where it communicates with the atmosphere but are confined to the inner piston chamber.

It will be noticed that the chief service of the "bobcheck" is to get the spring elements back as quickly as other considerations permit to the position in which they are ready for a new shock—the same that is done for an air tire by its rotation.

In the form of the "bobcheck" shown in Fig. 10, in which the damper adjustment is omitted, the question of oil leakage is eliminated by having the piston rod pass through a gland 5 at the top of the device, the packing serving merely to wipe the rod and intercept dust from the outside. The positive piston 3 is shown with a surface like the zone of a sphere, giving it only line-contact with the cylinder wall, and this permits the joints 6, 7, 8 and 9 to be simplified while allowing relative movements of frame and running-gear in any direction.

The other elements whose practicability must be established are the special type of cantilever spring, the air spring and, for heavy vehicles, the composite wheel.

Drawbacks of Ordinary Cantilever Springs

With regard to cantilever springs in general, it is mentioned as the greatest hindrance to their introduction that a manufacturer cannot successfully change from half-elliptics to cantilever springs without re-designing the chassis. The centering of the rear support of the frame at one point for each spring, instead of at the two points which the half-elliptic affords, furnishes an argument against the cantilever, as well as against the full-elliptic, if it means the need of strengthening the frame for the support of load and driving-stresses. In the case of open pleasure cars the margin of plain beam strength in the reaches is perhaps usually sufficient to cover the new demands without change of dimensions, so far as vertical stresses are concerned, but twists of the frame as well as whip and roll must be figured with; and the additional load, both static and dynamic, which the cantilever places on the front axle cannot be ignored. Fig. 11 illustrates roughly the relations which must be considered in changing from one type of spring to another. When the load distribution is to be left unchanged the wheelbase for the vehicle with half-elliptic springs, A, must be shorter than for that with cantilever springs, B, and longer than for that with reversed cantilever springs, C.

The latter type represents, however, as yet a problematic form of construction, and its value lies perhaps mainly in permitting a large vehicle body to be placed on a short wheelbase. Fig. 12 shows, obversely, how load distribution is affected when the wheelbase must remain unchanged. The fiber stresses are also much greater—four times greater at the main pivot—for cantilever springs than for the shackle attachments of half-elliptics, but in pleasure cars this can easily be taken care of by reinforcements.

The differences which appear when vehicle conditions with and without load are compared are indicated by vertical dotted lines in Figs. 11 and 12, on the assumption that without load the center of gravity comes about one-third of the length of the vehicle body behind the front axle and with load twice as far back. If this is the condition which is realized with regard to the frame and load in the vehicle with half-elliptic springs, it is plain that either another condition must be established in this respect when a change is made to cantilever springs, or else the wheelbase relations must be revised with a view to conserving the driving qualities under no-load as well as under full-load conditions; and these considerations also include the matter of the turning-radius of the vehicle, as it is determined mostly by the wheelbase.

On the whole, the change from half-elliptics to cantilevers cannot be made lightly. And it is more difficult for commercial vehicles, by far, than for pleasure cars. The relations of a heavy load to the fiber stresses becomes important, and in order to limit twist, whip and roll and even bending of the frame an extended base of attachment to the running-gear is desirable. For example, in a truck of the type where nine-tenths of the full load is supported on the rear axle, with a very considerable overhang of the frame and with the wheelbase as long as traffic conditions will permit, a change to cantilever springs would be impossible, and reversed cantilevers could only be contemplated in connection with re-building of the chassis.

As speed and comfort are demanded in pleasure cars in higher degree than in the majority of commercial vehicles and all the factors relating to wheelbase and load dis-

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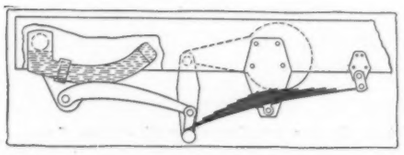


Fig. 13—Diagram indicating the possibility for getting frame and load broadly supported by the use of an air spring in conjunction with cantilever spring and "bobcheck." The air spring and the "bobcheck" are presented as operated from the axle and on the inside of the frame reach

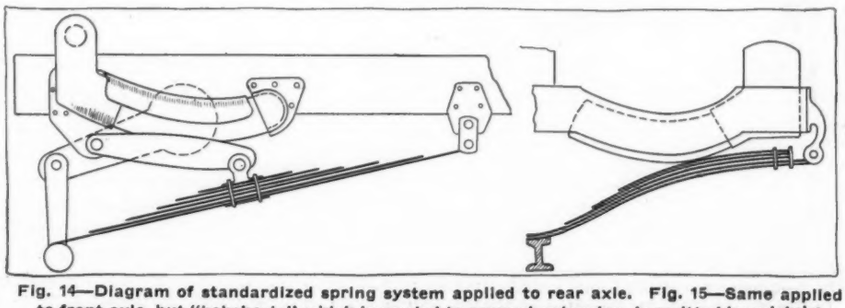
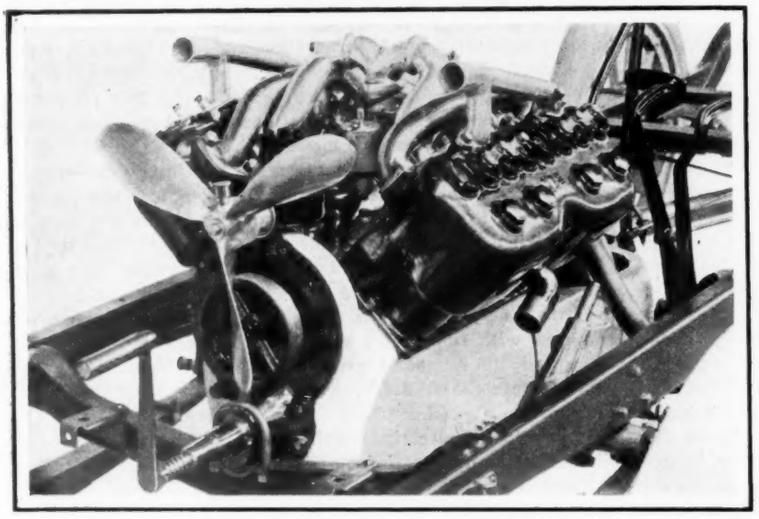


Fig. 14—Diagram of standardized spring system applied to rear axle. Fig. 15—Same applied to front axle, but "bobcheck," which is needed to prevent extension, is omitted by mistake

Hollier Eight Cleverly Designed

High Speed and Flexibility Feature Running—Accessibility of Motor and Refinement of Detail Conspicuous



The accessibility of the Hollier motor is better appreciated in the chassis plan view, but this shows the handy location of carbureter and igniter. Observe the three-blade aeroplane type fan which is driven from the camshaft. Front end of three-point suspension should be noted. The brackets seen on front cross member are for the radiator which is supported from the bottom, instead of the sides, and is thus relieved from frame stresses

IT was a surprise to the automobile industry to learn, early in the spring, that the Lewis Spring & Axle Co., Jackson, Mich., was coming out with an eight-cylinder car to be marketed under its own organization. For some 15 years the concern has been a parts specialist, making motors, springs, axles, gearsets, etc., for the trade, and its factories are really enviably arranged for complete car production. In fact, a well-known low-priced car has been built there for some time, but this is a part of the past, for only the Hollier eight, the name under which the new car will be marketed, is to be built.

Already the production is well under way. In the motor department the new engines are coming through at a lively rate. Axles and frames are being put together in another building of the Lewis group, and some of the chassis have already been through their road test, ready for bodies.

The Hollier is the lowest priced of the eights now on the market, selling at $985 with equipment. Its design is cleverly done and is clear cut. There is not any evidence of some forgotten part having been tacked on after the design was completed. Every unit seems to have been carefully considered and put where it is most advantageous.

The motor is a 3 by 4 1-4-inch V-type which differs in many details from any of the others on the market. In the driving system there is a cone clutch; three-speed, centrally-controlled gearset; inclosed drive shaft, and a compactly-designed floating rear axle. The rear springs are cantilevers, the wheelbase is 112 inches, and steering is on the left. An Apple motor-generator provides the electrical part, an Atwater Kent ignition distributer takes care of the firing, Stromberg carbureter is used, and oiling is commendably well worked out in the use of a pressure system. The standard body is an attractive five-passenger design.

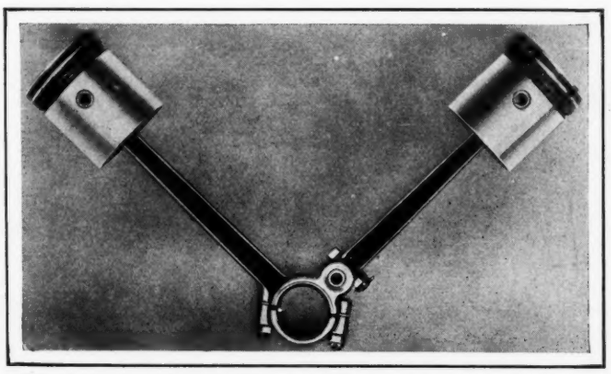
Taking into consideration the many things that have to be fitted to the engine, it is doubtful if a more accessible job could have been produced than the Hollier motor. The only apparatus in the V between the cylinder blocks are the carbureter and the combined breather and oil filler. The manifolds are compactly arranged so as to give easy access to the valve mechanism once the carbureter is out of the way; and the exhaust headers are bowed upwards to give room below them for the fitting of the intake manifolds.

The crankcase is a one-piece type with extreme vertical height to the sides, this promoting rigidity. Below it is the oil base through which the bearings may be reached, and in the center of the top between the cylinder blocks there is a plate which carries the rockers and allows access to the camshaft. The flywheel is not enclosed, but there is a cast-iron yoke passing around it and integrally forming the gearbox.

Unusual Connecting-Rod Design

Internally the engine is particularly noteworthy for the connecting-rod design and for its oiling system. The rods are chrome-vanadium steel forgings, and the attachment to the throw bearing is of the Gnome type; that is the main rod goes around the bearing just as a single rod in a four-cylinder motor would, but it has a knuckle on its side to which the smaller rod attaches by a steel pin in much the same form as a wrist-pin construction.

It is obvious that this form of attachment is very strong, for the driving force on the rod end is in line with the center of the bearing and the knuckle joint. The knuckle is really a part of the bearing portion of the rod end, and this allows it to be shifted over so as to be in direct line with the center line of the rod when the piston is at the top or bottom of its stroke. The main rod proper is 90 degrees from the other rod when in this position, and therefore it does not run upward from the center of its bearing portion but just as far on one side as the knuckle is on the opposite side. This allows the split for the cap to the horizontal. It has the



Simple connecting-rod construction used for Hollier eight

further advantage of making it possible to get at the cap bolts from below without trouble, since they are vertical, or nearly so, at all times.

The rod centers are 10 inches apart, and the wrist-pin is clamped in the rod with its bearing in the piston. The pin diameter is 5-8 inch and the length 2 5-8 inches. The crankshaft is a .40 carbon, heat-treated steel forging with three main bearings 1 5-8 inch in diameter of babbitt-lined bronze; the shaft is drilled for oiling by pressure.

Sixteen Cams Are Used

The valves are operated from a single camshaft by drop-forged rocker arms which are assembled on two small shafts mounted on the under side of the crankcase top plate between the cylinder blocks. These shafts, placed end to end, each carry the rockers for two cylinders on each side—eight rockers per shaft. They are so shaped that they fit very compactly in the space allowable, and without adding much weight, permit of straight upward force on the valve stems.

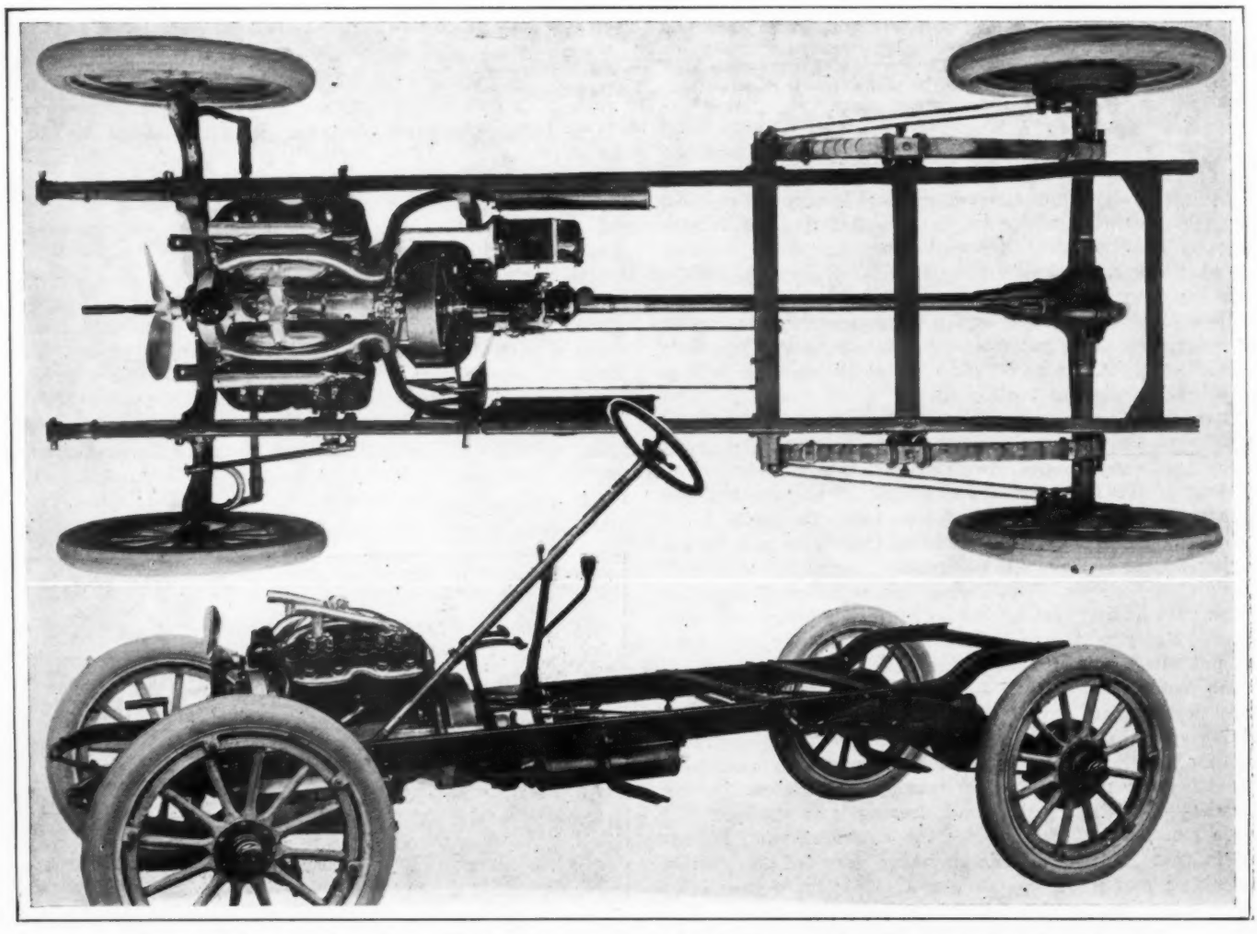
The valves have a clear diameter of 1 3-8 inch and they lift 3-8 inch from their 45 degree seats. Heads are cast iron, welded by the oxyacetylene process to heat treated, carbon steel stems. The camshaft has three bearings in the crankcase, its body being 1 1-8 inches diameter, and it is forged from .17 to .21 carbon steel, which is heat treated, case-hardened and ground. The camshaft drive is by helical gearing inclosed at the front. The crankshaft gear is of steel, while that on the camshaft is cast iron, this being the best practice for minimum wear and noise elimination. As an illustration of the far-sightedness of the Lewis engineer, holes have been provided in these gears for the admission of draw bolts, making it much easier and safer to remove them from their shafts than if a cold chisel and hammer had to be resorted to.

High-Pressure Lubrication

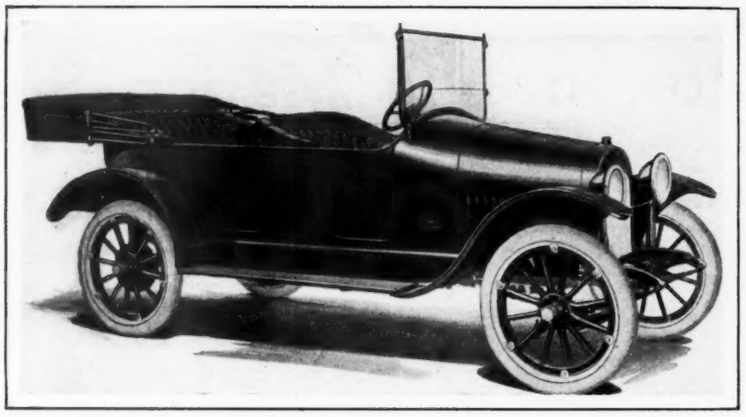
The lubrication system is remarkably simple for the results that are obtained. It was demonstrated to the representative of THE AUTOMOBILE that in ordinary running a pressure of from 10 to 40 pounds per square inch is used. There can be no doubt that wear is reduced to the minimum with such a pressure, allowing the bearings to really ride upon a film of oil at all times. A simple gear pump, located at the rear center of the crankcase and driven by the rear end of the camshaft, does the work. It draws the oil from the 3-quart oil base through to a strainer, and then pumps it under a varying pressure proportionate to the engine speed and within the limits above mentioned.

It is forced direct to the three main bearings, from which points it goes through the drilled crankshaft webs to the connecting-rod bearings. The pressure gauge on the instrument board indicates the pressure, and the only external piping is that to and from this gauge. One reason why it is possible to get the pressure as high as this in the Hollier motor is that the pump is of very generous proportions as compared with the engine size. In a demonstration run at high speed, the 40-pound gauge was bested, the indicator extending above the 40 mark, probably to about 45 pounds, this being at a car speed of about 50 miles an hour.

Coming to the electrical equipment, the Atwater Kent distributer works most satisfactorily in its position at the front, its drive being a part of the timing gear assembly. It con-



Chassis of Hollier eight, showing clean lines, construction of brakes and attachment of cantilever rear springs



Hollier eight-cylinder, five-passenger touring car which sells for $985

sists simply of mating bevel gears, which drive the vertical distributer shaft from the horizontal shaft.

The Apple motor-generator unit is mounted on the right arm of the yoke which goes around the flywheel. In this position it is out of the way as far as the engine is concerned, but is easily reached through the front floor boards of the car. It is the Apple A-25 type of the 12-6-volt design and is driven through the mainshaft in the gearset by a 1-inch Whitney silent chain. The chain centers are adjustable to take up any slack and the whole drive runs in a completely-inclosed compartment in the supporting arm just ahead of the gearbox. The same cover which goes over the gears covers the top of this chain housing, making it very easy to get at if necessary.

An interesting feature of the engine design is the timing gear housing at the front. This not only performs its main function of enclosing the gears, but it acts as a mounting for the propeller type of aluminum fan and also for the fan driving pulley, as well as the support for the front end of the motor and the mounting of the starting crank. Thus by removing this assembly, the engine is readily stripped of several of its important features. It makes a simple assembly proposition, as well as a neat design.

Special Features of Transmission

In the gearset, the gears are 5-8-inch face, and are chrome-vanadium steel forgings, heat treated. The teeth are 7 pitch, and they have a 17-degree pressure angle. The teeth are generated instead of being milled and a special lapping machine has been provided for grinding and polishing—the making of efficient gearing is by no means new to the Lewis shops, as already pointed out. The method used for making the gears is conducive to silent and accurate running, since proper meshing is assured.

Back of the gearset, the drive is through a 3.5 per cent. nickel steel universal joint to the drive shaft which is of ample proportions. This is enclosed within a torsion tube connecting conventionally to the rear axle housing. This latter is of the single ball-bearing, floating type, with solid swaged tubes pressed into a malleable housing. The driving gears have a 5-pitch and 1-inch face, with 20 degrees pressure angle and corrected tooth form, making for maximum of silence, it is said. The differential is of the regular four-pinion type with the driving gear a .20 carbon steel forging and the pinion a 3.5 per cent. nickel-steel part. The differential has Hyatt rollers for side bearings, and it is provided with ball thrust. The pinion bearings are New Departures, while in the wheels Gurneys are employed.

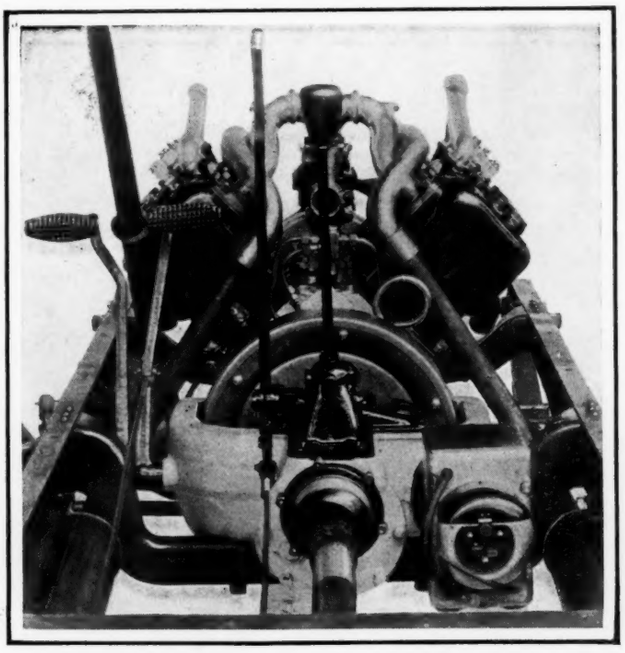
Tapered Axle Shafts

Like the drive shaft, the axle shafts are of chrome-vanadium steel and 1 3-8-inch mean diameter. The construction of these axle shafts is unusual in that they are tapered to give them ample strength at the drive end. In fact, the small end would be amply large to carry the load, but the taper adds an even greater factor of strength. The driveshaft and propeller shaft ends are six-splined, no square holes being used. This construction is very commendable. Brakes, operating in the usual way on the wheel drums are 12 inches in diameter, and are Thermoid lined. Both service and emergency sets are internal expanding on the inner surface of the drums.

The rear axle standard gear ratio is 4 to 1 which gives a great deal of flexibility to the car under driving conditions. The cantilever rear springs are long enough to give easy riding qualities and are attached to the axle in such manner as to allow each leaf to do its full share of work. Instead of clipping the end of the spring to the axle both the longest and the second longest leaves have eyes at the rear end and these are secured to the axle by a pair of shackle bolts passing through lugs on the axle end. Front springs are the usual half-elliptic and the steering gear is normal, though it is perhaps a little more substantial than usual for a car of this price class.

40-Horsepower at 2,000 R.P.M.

As regards performance, the Hollier will undoubtedly make a mark for itself. In test, it has proven its ability to go faster than 60 miles an hour, and in demonstration THE AUTOMOBILE representative was shown a speed of 35 miles an hour in second gear, while the car would throttle down to 3 miles an hour on high in smooth going. The engine readily handles the car, and attains 40 horsepower at 2,000 r.p.m. As regards gasoline consumption, it has shown its ability to go 12 miles on a gallon in ordinary country road work, up hill and down. Taken all in all, the car is an excellent example of what may be accomplished in the design of a low-priced eight.



The internal cone clutch is rendered accessible by the open type of transmission attachment. Apple motor generator is also well placed and wiring to battery is short. Observe spherical inclosure of universal

High-Speed Motor in 1916 Marion Six

Neat Layout, Careful Detail and High-Class Equipment Are Characteristics of New Chassis

MOVED from Indianapolis to Jackson, Mich., the Marion car will henceforward be made in the same factory as the Imperial, a new concern, the Mutual Motors Co., having taken over the old Imperial plant. It is understood that the Imperial four-cylinder and the Marion six will be the only two models made, but the factory is of a size sufficient to permit of a large output. Considering that the price is only $1,250 the Marion six is a particularly well finished and well equipped job, containing a good deal more real engineering than the average of assembled chassis.

Small Motor Gives High Power

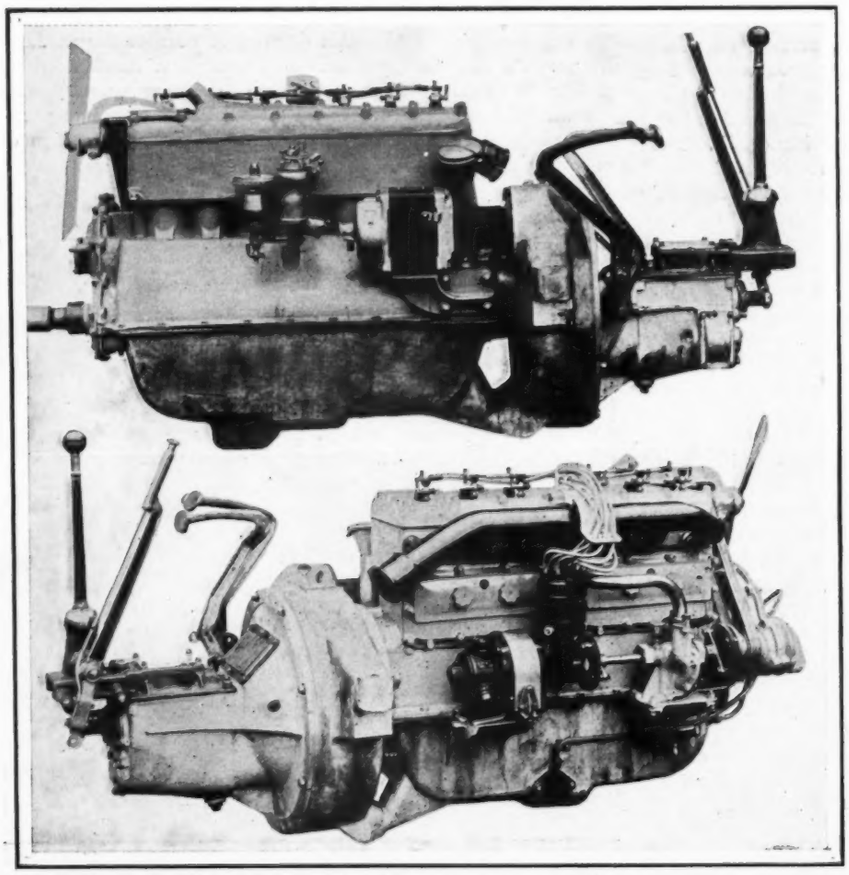
The engine used is a high-speed one of 3-inch bore and 5-inch stroke and thus has a capacity of 212 cubic inches. From this comparatively small volume it is stated that no less than 56 horsepower is obtained at 3,000 r.p.m., 31 horsepower at 1,500 revolutions and 22 horsepower at 1,000, these being quoted as average dynamometer readings. As can be seen from the illustrations, the motor is neat in appearance and has a detachable head, whereby access to the valves is obtained. The latter are on the right side of the cylinder block and very accessible, while the push rod mechanism can also be removed completely without trouble. In the illustration a pair of supplementary cover plates can be seen, attached by studs and nuts beneath the finger-nut-secured valve inspection cover plates. It is the lower plates that carry the push rods.

In the same view is also shown the manner in which the large water pump is driven through a substantial leather coupling and in turn drives the Westinghouse generator through a duplicate leather connection.

Latest Westinghouse Electrical System

This generator is the very latest type of combined generator and igniter. It is noticeable that the generator is very small and light, which is a feature of the system of regulation employed. For this is a constant voltage machine with vibrator regulation. This little machine can give a very large charging current when such is needed. Turning to the other side of the motor, the starting layout is seen, the Bendix drive being employed to connect the starting motor with the flywheel. It should be observed that the motor is well out of the way, although it is placed high enough to be itself well protected. When in the chassis it lies close to the steering gear.

This second view of the motor also shows a distinctive point in its design, namely the bridge piece which is used to connect the bottom of the crankcase to the flywheel housing. The aeroplane type of two blade fan and the newest Stromberg carbureter are also details made clear.



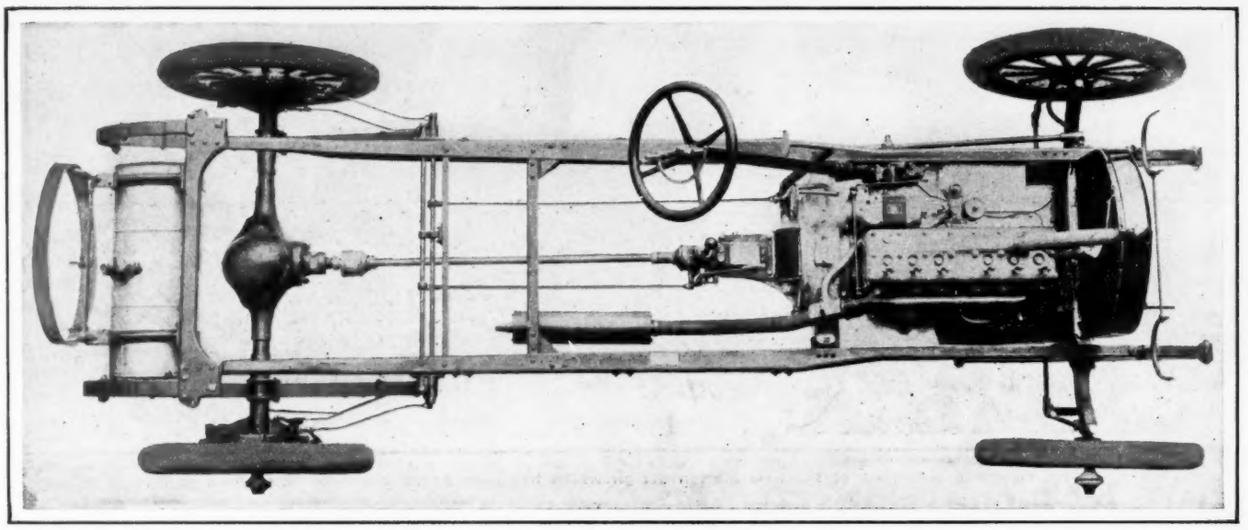
Motor of 1916 Marion six, showing detachable cylinder head, which gives access to the valves. Note the supplementary cover plates attached by studs and nuts beneath the valve inspection cover plates. The lower plates carry the push rods. Mounting of electrical units is also shown

Simple Lubrication

The trough system of splash lubrication is used, there being a vane pump on the rear end of the camshaft which sends oil to the dip troughs, to the helical timing gears and to ducts which feed the main crankshaft bearings, of which there are three. The fact that the upper half of the crankcase is integral with the cylinders allows the bearing support to be exceptionally rigid, so discouraging any tendency to crankshaft distortion or whip. Owing to the use of cast iron, however, the oil leads must be separate and are carried externally.

Special care is taken with the pistons, which are cast iron, machined both inside and out, so that it shall be possible to insure their even weight. Only two piston rings are employed, these being concentric, these aids to high speed being assisted by the valves which have a clear diameter of 1 5-16 inch and a lift of 5-16 inch.

It is noticeable that the Warner gearset is small externally, but this is not obtained by any reduction in the

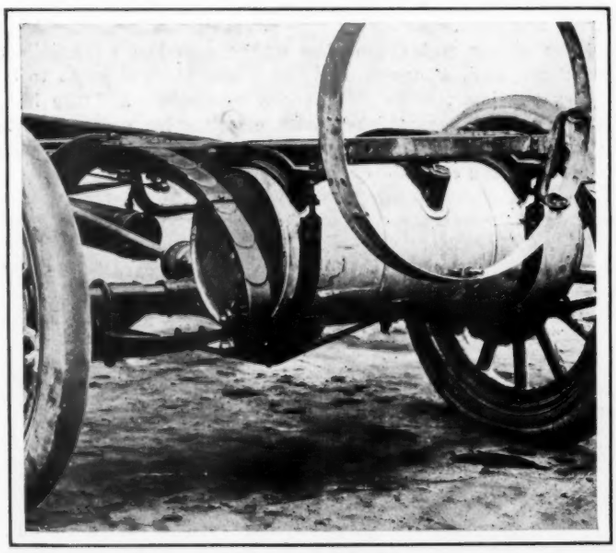


Chassis layout of the Marion six for 1916, showing mounting of power plant and electrical units. Note compact gearset and double-jointed driveshaft

dimensions of the gears themselves; it is simply due to the fact that there is no wasted space. There are, of course, three speeds. The clutch is also of Warner make with six disks of steel on the driven member and five with Raybestos facing on the flywheel member. There is a handy adjustment for setting back the clutch pedal to compensate for wear in the striking thrusts which is discernible in the motor illustrations.

The propeller shaft is a double-jointed or open type, but a feature in its design which is unusual is the location of the sliding joint at the front end. Both universals are similar in detail but that on the bevel pinion shaft is keyed and locked in place, while the front one is free to slide on a square ended shaft. As is usual with this kind of propelling member, there is no torque stay, the springs being utilized to resist the stress. This much-discussed principle undoubtedly is far less easy to criticise—or perhaps one might say is seen at its best—when the motor speed is high. It is the coming of the high-speed engine with its even torque that has led to the European popularity of the so-called Hotchkiss drive.

Also, on the Marion six the rear springs are long enough and wide enough to take care of any amount of torsional stress. They are hung beneath the axle and supplied with self-lubricating shackle bolt bushings packed with a graphite compound that makes additional lubrication unnecessary and renders squeaking extremely improbable. Bushings of the same sort are, of course, also used for the front springs.



Rear view of Marion six chassis, showing internal type of spare tire carrier. Note that gasoline gauge is integral with the filler cap socket, simplifying construction and minimizing probability of leaks

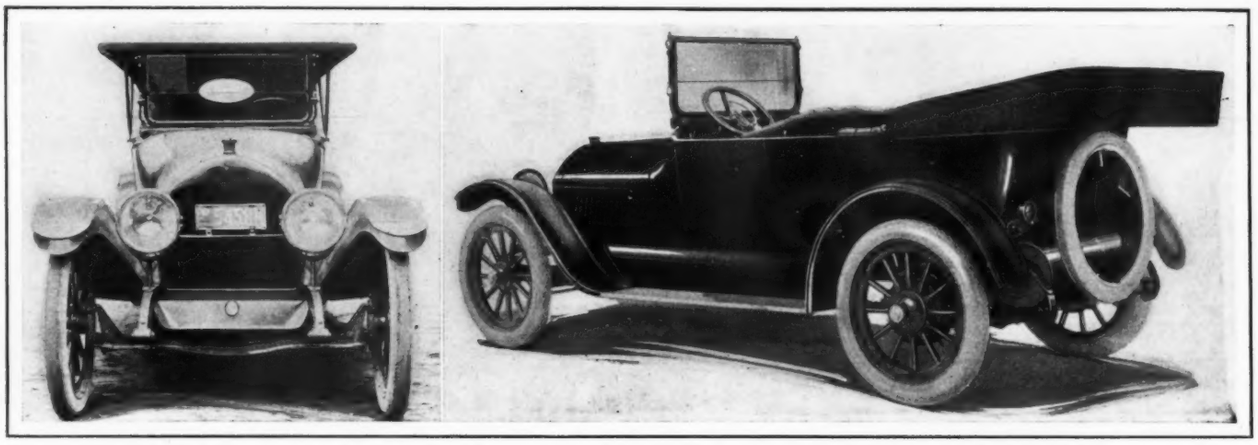
In the rear axle spiral bevels are used, cut by the Brown Lipe Chapin Co., and these, with the differential, can be removed from the axle housing by simply taking off the cover plate and then removing four bolts. The center portion of the axle is a casting and the sleeves steel tubes to which the brake brackets are attached. The brakes follow standard practice, but it is worthy of comment that the adjustments are particularly accessible and the external service brake has an adjustment for setting it concentric with the drum in addition to the usual means for taking up wear. Rattle in the connections is unlikely because of the straightness of the pull rods and the small number of parts necessary for the layout.

On the front axle it is claimed that the swivels are stronger than usual for a car of this weight and their lubrication is well cared for by the large grease cups and properly arranged grooves to carry the lubricant to the points where it is needed; it should be noticed that the drag link is perfectly straight, a feature which, by removing springiness, usually makes for steady steering.

Body Comfort Notable

The body fitted is a steel construction with very smooth lines and is just a nice size for five passengers, being supplied with ample leg room but not too long a floor to the tonneau. As long as there is room for a passenger of a little over the average height to stretch his legs, a rather short tonneau certainly is less draughty and more comfortable than one which is extremely long. Also it is always an advantage not to sit too far back over the rear axle, and in the Marion a very happy mean is struck. Concealed hinges, deep upholstery and a top which lies low when folded are other conspicuous body features. With respect to the top, this is leather and has a cover of the same material. Other equipment includes a Stewart speedometer driven from the front end of the driveshaft, a ventilating windshield to which the one person top attaches, a vibrator horn with button in center of steering wheel and all other usual kit and accessories. Tires are 33 by 4 inches.

A detail which should be noticed is the tire carrier which



Front view and side view of the new Marion design which has been brought out for the season of 1916

is internal instead of external, as is usual. This supports the demountable rims on a ring, similar to the bonding rim of the road wheel, so that the tires do not rest against anything whatever and cannot, therefore, chafe. The valve and a single cleat hold the spare tire and its rim secure and rattle proof, while detachment is the work of an instant only.

In the same view which shows this carrier the round gasoline tank may be seen and it can be observed that the gasoline gauge is made integral with the filler cap socket. This does away with one hole in the tank and is both a simplification and a rank preventative, for the smaller the number of holes cut in a tank and the less the number of joints to be made, the less must be the opportunity for severe bumping to produce a crack anywhere. A Stewart vacuum feed is used to lift the fuel from the tank to the carbureter.

Altogether the impression given by the Marion is of a well designed, comfortable, roomy vehicle of light weight and ample power. It is an automobile with a distinct individuality.

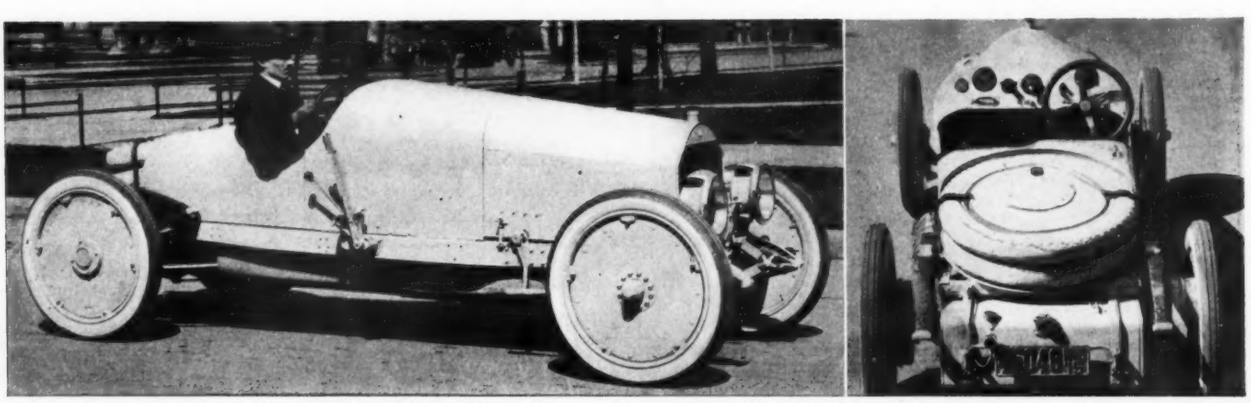
A Rebuilt Vanderbilt Cup Racer

IT is always interesting to know what becomes of the old racing cars which have made famous records in past contests. A good example of what can be done with one of the old racing chassis is shown in the accompanying illustration. This car is now the property of W. O. Streller of the Irvin Robbins Co., Indianapolis, Ind. It is built on the Marmon chassis which Joe Dawson drove in the Vanderbilt Cup Race in 1911 on Long Island. This was the race that Dawson lost by 30 seconds, due to his stopping for several minutes to ascertain the injury to a spectator who ran upon the track in front of his machine and was struck.

Practically all the work upon the car is of special design, giving a body and chassis which is unusual in many respects. The specifications include a 4.5 by 6.5 motor with a 2-inch carbureter, 2.5-inch valves, Bosch magneto, three-speeds forward, geared 2.3 to 1 on high. The wheelbase is 120 inches. An added touch is given by a full equipment of dash instruments mounted in a cowlboard, including a 100-mile speedometer, electric clock, Presto primer, etc. The gasoline feed system is the Stewart-Warner vacuum.

It is very difficult to estimate exactly how much a job of this kind could be done for, as the price of the original chassis will, of course, be the determining factor and this will vary greatly. Then the cost of overhauling the chassis would vary with every car. As regards body work, however, the cost of this work would be in the neighborhood of $400, including the building of the body, installation, trimming and painting and the metal disks for the wheels. A unique feature of the body is that it is altogether metal with the joints welded with acetylene.

The owner states that the ex-racer makes an excellent road car, and, although it is never run more than 45 to 50 miles per hour, it holds the road excellently and the high speed can be accomplished with comparative safety. It is claimed that a maximum speed of 95 miles per hour is possible with the car.



Side and rear views of the Marmon rebuilt car which practically won the Vanderbilt cup race in 1911

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The Truck Convention

THE truck convention at Detroit, the first under the auspices of the National Automobile Chamber of Commerce, was a success. Men of the highest caliber in the truck field were in attendance to discuss the various problems that confront the industry, and to give others the benefit of their experience.

Those who attended the convention, who became acquainted with their brother manufacturers and who listened to the words of wisdom from men who have through their success proven that their theories are correctly realized that they would have made a great mistake not to have come. It may have taken them away from their duties at the factories for a couple of days, but the enthusiasm, the general wealth of valuable information and the real good will which they enjoyed from all the rest made them feel that they were cashing in on the investment of time.

The sessions were attended by representatives of about seventy-five truck manufacturers and the pity is that all in the business could not have been there. Certain it is that more of them would have come had they realized just what real inside information and benefit they could get from the other fellow.

To some extent it was a conscience party. They told their troubles to the gathering, and solutions to their problems were offered by others who had been through the same mill. The new maker cannot help but benefit from the experience of his older competitor; the old maker, often times fallen into a rut, can get a new perspective from the younger concern.

The National Automobile Chamber of Commerce is doing its part. It is lending its valuable assistance to the furtherance of the truck industry, but it cannot mother that industry. It is growing and must rely upon itself through the energetic support of all in the business. Another convention has been decided upon for the fall. Let us hope the short-sighted makers who did not avail themselves of the opportunity to learn of the secrets of the other fellow's success will turn out in force then.

Let them swell the attendance at the next meeting to triple what it was at the Detroit gathering. Let them make the 200 delegates look like a mere handful as compared with the number at the fall convention.

Common Sense About Bearings

THE case for ball bearings versus roller bearings or roller against ball has been argued for more years than measure the existence of the automobile industry, and the battle still rages as fiercely as ever. Yet the engineer who uses these bearings knows quite well that both types have their good and bad points, that there are good and bad kinds of the one just as there are better and worse sorts of the other. Theory is a very dangerous thing when it is applied to mechanisms of such extraordinary delicacy as modern anti-friction bearings, because there is still much in their behavior that no theories have yet been found to explain; nor does it follow that either ball or roller is necessarily superior in practice, even supposing it could be proved that it is superior in theory.

To the engineer the only thing of any value is accumulated experience, and as most automobile engineers have plenty of data concerning both types of bearing it is to be expected that they will continue to use balls where they regard them as most satisfactory and rollers for other parts of the same chassis. There is good reason to suppose that while a car can be designed to use all ball or all roller bearings the present practice of using both, according to the particular sort of service needed is a thoroughly sound procedure. To Europe belongs the honor of making the first good ball bearings and to America that of producing the first rollers equally satisfactory. America can now take care of herself in the former respect, and Europe will soon be able to produce roller bearings in quantity. On the introduction of good roller bearings into England the automobile men soon found their applicability and are using them increasingly. Conversely, the American engineer is using more ball bearings as the supply increases; so one is forced to the conclusion that, argue as you may, there must be sound basis in fact for both types and that both types will continue in use. Each type has virtues peculiar to itself and each has also faults inherent with its principle, so that for some uses the ball bearing is preferable, when all things are considered, and for other parts the roller suits conditions best. Nor is it possible to draw a definite line between their spheres.

New Willys-Knight Under $1,200

J. H. McDuffee to Boost Sales and Conduct Dealers' Educational Campaign

TOLEDO, O., May 11—*Special Telegram*—A Willys-Knight car to sell for less than $1,200 will be brought out shortly by the Willys-Knight interests of the Willys-Overland Co. This model will be a new car throughout and will be the first Knight-engine car to be marketed under $1,400.

Joseph H. McDuffee has been appointed general representative for the Willys-Knight interests of the company and will devote his entire time and attention to promoting the sales of the new car.

McDuffee will call upon every Willys-Overland distributor in the United States and through personal contact with the 4,000 or more dealers will promote a campaign of education relative to the mechanical merits and technical features of Knight engine construction.

The decision to produce such a car and the appointment of Mr. McDuffee to the duties of familiarizing the dealers who will market the output with the Knight "reasons—why" is the latest business stroke of John N. Willys who is rapidly building an organization made up entirely of the real business men of the industry. Mr. McDuffee managed the first automobile retail store in America in New York during 1898 and has been continuously identified with the retail end of the industry ever since.

404 Cars Shipped May 10

The plans for Willys-Overland and Willys-Knight sales campaigns are staggering in their proportions and the public is warranted in expecting President Willys to further sensationalize the industry. Four hundred and four Overland cars were shipped May 10, which surpasses the greatest single previous Overland day's shipment by nearly 100 cars. The present week will exceed 1,800 cars shipped.

—

Page Takes Mitchell—Houpt Now Hudson Agent

NEW YORK CITY, May 11—Several changes of importance have been made in the dealership situation in this city. Carl H. Page has formed the Carl H. Page Motors Co. and has taken over the Mitchell agency, until now held by Harry S. Houpt, Inc. Houpt, in turn, has taken the Hudson agency, until now held by the A. Elliott Ranney Co. General Manager S. S. Toback of the Ranney company, which is one of the best equipped dealerships in the metropolis, declines to state what his company plans to do.

Page, who will cover New York and Philadelphia, with headquarters at West 59th street and Broadway, formerly was the Chalmers dealer here until the agency became a branch. He has lately been connected with the Owen magnetic-drive car, made by Ray M. Owen, who recently bought an interest in the Houpt company.

—

Jeffery, Lewin and Meriheina Saved from Lusitania

NEW YORK CITY, May 11—Charles T. Jeffery, president of the Thomas B. Jeffery Co., Guy F. Lewin, who recently closed for the representation in London of several American cars, and William Meriheina, bound for South Africa in the interests of the General Motors Export Co., were rescued when the Lusitania was sunk last Friday.

Mr. Jeffery was on his way to England in connection with contracts with the allied nations for war trucks. Meriheina was recently appointed South African service representative of the General Motors Export Co. and was bound for that country, where he was to devote his time chiefly to the demonstration of the ignition and self-starting features on the company's cars. Prior to his appointment, Meriheina had been with the New York City Buick branch for the past 5 years.

—

Pietrantoni, of Porto Rico, in New York

NEW YORK CITY, May 10—R. M. Pietrantoni, of San Juan, Porto Rico, member of Pietrantoni & Sojo, a large automobile house in Porto Rico, is now in this city.

—

Humphrey Chalmers—Owen a Director

DETROIT, MICH., May 7—S. H. Humphrey, recently appointed works manager of the Chalmers Motor Co., has been elected vice-president in charge of manufacturing. Percy Owen, general sales manager of the company, was elected a member of the board of directors. The company has appointed L. F. Johnson as assistant district supervisor, with headquarters in Atlanta, Ga. Mr. Johnson was formerly a district manager for the Willys-Overland Co., Toledo, O.

—

Laycock Sails for England

NEW YORK CITY, May 10—Arthur M. Laycock, chief engineer of the Sheldon Axle & Spring Co., Wilkes-Barre, Pa., sailed for England Saturday to represent his company in connection with business affairs. Mr. Laycock has spent considerable time abroad during the past 6 months.

S. G. V. Assets To Be Sold May 27

Receiver's Petition for Order To Sell Granted—Industry's Prosperity One Reason

READING, PA., May 7—The assets of the S. G. V. Co., of this city, will be sold at public sale on Thursday, May 27, at 1:30 p.m., and thereafter from day to day until all the property is sold. Judge G. A. Endlich has granted the petition of R. E. Graham, receiver for the company, for an order to sell the assets.

Mr. Graham states that he has been unable to sell the plant. In asking for an order of sale he states that at this time there is an improvement in the condition of the automobile trade and that he thinks it to the best interests of the creditors and stockholders that the assets be sold at public sale, especially in view of the fact that the daily rental of the building in which the business is being conducted is in excess of $50.

—

Maxwell Preferred Placed on 7 Per Cent. Basis

NEW YORK CITY, May 12—The directors of the Maxwell Motors Co. yesterday declared an initial quarterly dividend of 1 3-4 per cent. on the first preferred and an additional payment of 3-4 of 1 per cent. on account of accumulated dividends. The dividends are payable July 1, to stock of record June 10. Transfer books do not close.

The company has outstanding $12,279,332 first preferred 7 per cent. cumulative stock, $10,127,467 6 per cent. non-cumulative second preferred stock, and $12,778,057 common stock. The first preferred stock has been cumulative since January 1, 1913, at the 7 per cent. rate.

It is estimated that the net balance of earnings for the current year will amount to about $3,000,000 compared with $1,505,000 in the 1914 fiscal year.

—

18 Paige Stockholders Get $17,500 Monthly Dividend

DETROIT, MICH., May 11—Eighteen stockholders of the Paige-Detroit Motor Co., this city, have received $17,500, their monthly dividend, which is at the rate of an annual dividend of $210,000 on a capital of $250,000. It is reported that earnings for March and April are sufficient to pay all dividends for the remainder of the present year.

—

Mackenzie, London Publisher, Here

NEW YORK CITY, May 12—John Mackenzie, a London publisher of automobile and motorcycle magazines, is at present in this country investigating manufacturing conditions.

Packard's April Sales $3,047,811

33 Per Cent. Gain Over April 1914—Plant To Be Enlarged 5.7 Acres

DETROIT, MICH., May 8—The total sales of passenger cars, trucks and parts of the Packard Motor Car Co. during April totaled $3,047,811, as compared with $2,260,150 in April, 1914. It was the biggest month in the company's history and indications are that May will also be a banner month.

Extensions to the plant of the company either in course of construction or to be started represent a total outlay of more than $200,000, and when completed will provide the concern with 43.7 acres of floor space, as compared with 38, which was the total before the factory expansions were started.

It was decided that in order to manufacture sufficient wheels, a new building, 60 by 393 feet, should be erected. It is now in course of construction, and in addition to the wheel machine and wheel paint departments it will contain improved dry kilns capable of drying the material for 400 wheels daily.

A new six-story building, 60 by 400 feet, which will have special machinery to be used in the machining of chassis parts, will be erected on the site now occupied by one of the original factory buildings, put up 12 years ago. It will be of the flat slab type of reinforced concrete with special two-way reinforcing, and when completed will be one of the most unique factory structures in the country.

A one-story heavy steel structure, 180 by 240 feet, will be added to the truck shops. The roof trusses will be designed to permit heavy overhead trolleys of sufficient strength to carry a completed truck.

The extra pressure on the forge department has required that the manufacturing dies be moved in a building specially built for that purpose. This structure, 26 by 144 feet, is equipped with a complete trolley system for handling the dies, and the storage racks are built of heavy structural steel and arranged in the manner of an amphitheater.

Pittsburgh Model Engine Co. Has High-Speed Six

PITTSBURGH, PA., May 10—The Pittsburgh Model Engine Co., this city, has brought out a six-cylinder, L-head block motor 3 by 5, with a piston displacement of 212 cubic inches and a stroke-bore ratio of 1 2-3 to 1. Light reciprocating parts are a feature and the entire three-point power plant complete with three-speed gearset weighs only 450 pounds, the motor itself weighing but 350, with bell housing.

Compactness is characteristic, the overall length of the cylinder block along the center line of the valves being only 27 inches. Valves, ignition system and water pump are on the left and the carbureter is on the right, being closely connected to the cylinder block so that the gases pass through the water space between the two center cylinders. Valves have 30-degree seats and are 1 5-8 inches in diameter with 1 3-8 clear openings. Crankshaft is a three-bearing type 1 3-4 inches in diameter and camshaft also has three bearings, being 1 inch in section. Cast iron pistons with three eccentric rings actuated by 9-inch connecting-rods, the lower bearing being 1 3-4 inches in diameter and 2 inches long. Timing gears are helically cut and run in oil.

Oiling is an important feature, the standard plunger pump, constant level splash type being used with individual troughs for the connecting-rods and, in addition, the space around the camshaft is filled with oil under pressure, this giving positive lubrication and promoting quietness of operation.

The motor is designed for all makes of single or double unit electric starting and lighting systems and is made with either cone or multiple disk clutch and for magneto or battery coil ignition.

The maker claims that tests show 45 1-2 horsepower at 2,150 r.p.m., 39 horsepower at 1,600 r.p.m. and 26 horsepower at 1,000 r.p.m.

Hupp Turns Down 900 Orders

All 1915 Cars Sold—April Record Month—25% Gain for Fiscal Year

DETROIT, MICH., May 8—During the last 10 days the Hupp Motor Car Co. has turned down nearly 900 orders for its 1915 cars owing to the fact that the entire production has been completed and sold.

The month of April was the biggest April since the organization of the company, being about 15 per cent. better than the corresponding month in 1914, which was a record breaker.

The business for the entire fiscal year will show about 25 per cent. increase over 1914.

At the present time there are about 1,200 men on the payroll.

Simpson Is Manufacturing Manager of Hupp Motor Car Co.

DETROIT, MICH., May 7—Howard Simpson has been appointed manufacturing manager of the Hupp Motor Car Co. He was formerly with the Chalmers Motor Co.

Studebaker Breaks All Records

War Orders Alone Were $17,000,000 in 1914—April Best Month for Car Sales

SOUTH BEND, IND., May 10—Business and profits in the current fiscal year of the Studebaker Corp. are by far the largest in the corporation's history. War orders received late last year were around $17,000,000 and a large part of that business was carried into the current year. During the present year it is reported that additional orders have been received from Great Britain and France for automobiles, wagons and harness, the estimated value of which ranged from $3,000,000 to $5,000,000. Besides domestic business in the current season has been running large.

Never in its history has it had a month to compare with the one just closed. April marks high tide for the automobile, all sales records being smashed.

One interesting fact displayed by the sales sheet of the corporation is the increase of the sales of sixes over fours.

Enlargements of the plants are now being made so that production for the season of 1916 can easily take care of 60,000 machines.

As evidence of the general automobile prosperity, the Chicago branch of the Studebaker Corp. has just closed the biggest month in its history. In April 828 cars were sold in that city alone.

Todd Buys Sta-Rite Parts

DETROIT, MICH., May 11—Charles D. Todd has purchased for $500 the personal property consisting of machinery, etc., of the bankrupt Sta-Rite Corp., Utica, Mich., which made the Sta-Rite carbureter.

Hayes Annual Banquet—Business 25% Better than 1914

DETROIT, MICH., May 10—The second annual banquet given by the Hayes Mfg. Co., to the heads of its different departments, took place at the Hotel Cadillac, with about seventy Hayes men and some invited guests present. D. K. Stephens, factory accountant, presided and among those present were: H. J. Hayes, president; H. L. Bill, general manager; E. D. Emmons, sales manager; E. D. Carrow, treasurer; H. R. Deering, superintendent; C. E. Drum, factory manager; J. J. McClintock, storekeeper; Hal H. Smith, a director; C. E. Colton, former assistant sales manager; F. B. Everitt, former manager body works.

At the present time about 900 men are employed in the Detroit plant and about 350 in Ionia. April business was 25 per cent. ahead of last year's April.

Advertising Opens S. A. Markets

Must Be Constant—Early Sales of American Cars at Exorbitant Prices a Handicap

NEW YORK CITY, May 7—Some of the handicaps which American automobile manufacturers at present endeavoring to develop South American business have to overcome, are brought out by R. C. Tort, a representative of Argentina in this city. Mr. Tort refers to the early sale of American cars in South America when unreasonably high prices were charged for them. He cites cars that sold in this country at $1,250, which were sold in the Argentine at $2,000 and as high as $2,500. There was literally no reason for this added price because the duty of 25 per cent. plus 10 per cent. custom house duties brought the total price up to less than $1,700, but on top of this $800 was added.

One of the difficulties with some American concerns at present working on the South American market is that their advertising campaigns are not consecutive. Mr. Tort cites how necessary it is in the United States to have a constant advertising campaign, and claims that in order to reach the South American market it is necessary to have a similar campaign and to carry in the advertisements the real truth about the vehicles. The characteristics of each car he thinks should be carefully outlined so that buyers will have some material upon which to reason as to the suitability of such a car for them. He cites that today the term "coffey-pot" is heard in parts of Argentine as applied to some of the early American cars that flooded the market there.

The South American buyer, particularly in Argentine, is entirely familiar with a score or more makes of European cars which have been in the country for many years and from these he has obtained his earliest knowledge as to the performance of a car for a given price.

Goodyear Sales Conference To Be Held on Coast

SAN FRANCISCO, CAL., May 8—With the arrival in San Francisco of F. A. Osterloh, sales manager of the Goodyear Tire & Rubber Co., plans are being arranged to hold the annual Goodyear conference for 1915 here instead of at the Akron factory.

Packard Dealers in Session

DETROIT, MICH., May 8—The first two conventions of Packard dealers and distributors were held last week and will continue for the next 5 or 6 weeks. This year the Packard Motor Car Co. has departed from its former custom of having only one general convention. It has been found a better policy to gather only a small number of dealers at a time, a dozen or so, and to have them come from various sections of the country, instead of from the same state or section only. In this way the dealer or distributor can be given better attention and in a more personal way. The representatives who have been here the past week expressed themselves as confident that the automobile business will continue prospering.

Sells 63 Fords in 1 Day

WINNIPEG, MAN., May 8—The Ford branch in this city recently sold sixty-three cars in a single day. This number represents orders that actually came in for immediate delivery to Manitoba dealers under the local branch. Mr. Malcolmson, branch manager, thought his record of last week of twenty-five sales in 1 day would stand for some time, but it has been eclipsed. Sales in this city during the month of March show an increase of slightly more than 100 per cent. over the same month in 1914.

Melhuish Joins Midgley Tire

LANCASTER, O., May 10—W. F. Melhuish, who will be remembered as sales manager of the Royal Tourist and the Croxton-Keeton for several years in the past, is now identified with the Midgley Tire and Rubber Co. as general representative.

Kriedeman Is Superintendent of Standard

DETROIT, MICH., May 10—C. C. Kriedeman has been appointed superintendent of the Standard Motor Truck Co., manufacturer of the Standard truck in Detroit.

Bender Goes to Overland

TOLEDO, O., May 10—John L. Bender, formerly of Timken-Detroit Axle Co., and American Ball Bearing Co., and recently sales manager of Grant-Lees Gear Co., Cleveland, has been appointed distributor of the Overland product in central Pennsylvania. Bender has acted as district manager in central Pennsylvania for the past year. He will take headquarters at Altoona.

Van Speedometer on 1916 King

DETROIT, MICH., May 7—The Cutting, Armstrong & Smith Co., Michigan representatives for the Van Sicklen speedometer, have closed a contract with the King Motor Car Co. for its 1916 equipment. The company has received an order from London, England, for forty-five more eights, making 236 cars shipped to London in 6 weeks.

7,686 Cal. Registrations in April

Revenue for Less Than 4 Months Is $325,074 Above Total for 1914

SACRAMENTO, CAL., May 7—Automobile registrations in California for the month of April total 7,686 cars, according to the figures issued at the state motor vehicle department. The total, however, is not entirely for new cars but includes the registration of quite a number of old cars on which lax owners had not paid the registration tax.

MAKE	MARCH	APRIL
Ford	2,695	2,669
Studebaker	745	601
Buick	575	533
Overland	720	523
Maxwell	378	381
Dodge	239	237
Cadillac	263	201
Reo		196
Mitchell		125
Hupmobile		118
Chalmers		106
Jeffery		98
Hudson		80
Metz		77
Regal		75
Oakland		70
Kissel Kar		55
Oldsmobile		54
Franklin		53
Locomobile		34
Packard		27
Pierce-Arrow		26

Trading during the closing weeks of April in San Francisco and, in fact, throughout the northern California district was not as brisk as at the opening of the month because of inclement weather. In the southern portion of the state dealers are reporting a good measure of activity, especially in the medium-priced lines.

As the registrations show, the eight-cylinder Cadillac is making a most favorable impression in all parts of the state and the California representative is experiencing difficulty in securing the cars fast enough to make deliveries.

The two Ford assembling plants in California are working to capacity and the cars turned out are being picked up quickly by a metropolitan demand as well as a call from the country districts.

According to an official statement issued by the the state treasurer on April 19, the gross revenue from the 1915 collection of automobile, motorcycle and chauffeur taxes and licenses amounts to $1,663,859.25. This covers a period of 3 months and 19 days. As the receipts of the motor vehicle division during 1914 were $1,338,785.25, the 1915 receipts are already $325,074 in excess of the previous year's returns. This big increase with more than eight months yet to come in, is not due entirely to the greater number of machines registered, but is accounted for largely through the excess licenses collected under the McClure displacement method of rating automobile horsepower.

Texas Wants Light Motor Trucks

Improved Roads Open Big Field — Crop Outlook and Cotton Prices Excellent

AUSTIN, TEX., May 6—One of the satisfactory features of the automobile trade in Texas at this time is the increase in the demand for delivery vehicles of the lighter type. More sales have been made of this class of motor commercial cars during the last 2 months than in any similar period of the history of the trade in this state. The demand is not confined to the larger cities, but extends to all the smaller towns. This is particularly true of the more progressive and growing communities of South and West Texas. The fact that the street paving movement during the last 2 or 3 years has extended to almost every town in the state of 5,000 population and upwards has made the use of the motor delivery vehicle a very desirable feature of many lines of business.

The motor truck trade in Texas is also unusually good and it promises to be still better later on in the year. Crop prospects are excellent. Heavy and timely rains have placed the ground in fine condition for planting. The temporary depression that existed for several weeks during the late fall and early part of winter, due to the drop in cotton prices, is no longer felt to any marked degree, even in the recognized cotton-growing territory of Texas. Practically all of the last year's cotton crop is now out of the hands of the farmers and they received prices ranging from 7 to 9 cents for their product. Money is plentiful and the people as a whole are prosperous.

Auto Parts Reduces Prices on Accessories to Jobbers

PROVIDENCE, R. I., May 8—The Auto Parts Co., this city, has reduced jobbers' prices 50 per cent. on its muffler cut-out, valve stem adjusters and tire grip sets. A reduction of one-third was made on coil box switch keys and 40 per cent. on rear number holders. These prices apply to lots of 100, and in cases where jobbers have stocks on hand the discount on the stock will be given in additional merchandise, but applies only to merchandise bought this year.

Chicago Wants Wheel Tax Back

CHICAGO, ILL., May 11—After fighting for years to have its wheel tax removed Chicago has now decided, after the tax has been declared unconstitutional, that it wants it to be enforced again because of the money coming from the wheel tax being used for street improvements. The Chicago Motor Club in a recent ballot of its members as to whether they were in favor of the wheel tax voted 95 per cent. in favor of an amendment to the present motor vehicle law reinstating the wheel tax in Illinois cities. Four other motoring organizations in this city have passed similar resolutions.

Juergens Goes to Chicago

FREMONT, O., May 10—Theodore Juergens will sever his connection with the Lauth-Juergens Motor Car Co., this city, and go to Chicago, where he will become its selling agent. The plant has a number of orders, including a 100-truck order from Europe.

U. S. L. Committee Extends Time on Payment of Assessments

NEW YORK CITY, May 12—The reorganization committee of the United States Light & Heating Co. has extended the time for payment of assessments, which expired on May 5, for a further period, and announces that to date about 80 per cent. of the 21,131 shares of preferred stock have paid $15 a share assessment and nearly 66 per cent. of the 62,559 shares of common have met the $2.50 a share assessment. The amount received to date on the preferred stock totals about $250,000 and on the common more than $100,000, or a combined total of 74 per cent.

Inness Takes Charge of Chase Philadelphia Branch

PHILADELPHIA, PA., May 8—J. A. Inness, a Chase representative in the earlier days, and who for the past 2 years has been in charge of the motor truck department of the Chicago Pneumatic Tool Co. in the Philadelphia territory, has assumed the management of the Chase Motor Truck Co.'s branch, succeeding A. E. Fisler. Extensive improvements will be made at the Philadelphia branch, a complete service station will be installed and all the territory comprising Eastern Pennsylvania, New Jersey, Delaware, Maryland and District of Columbia will be hereafter served by the Philadelphia Chase organization.

F. B. Porter has been appointed export manager of the company. J. B. Sperry, formerly with the Federal truck and Briggs-Detroiter companies, also has joined the Chase organization.

Russel Factory Additions

DETROIT, MICH., May 12—The Russel Motor Axle Co., North Detroit, recently broke ground for a new concrete building 120 by 30 feet, this being the first of four units of the same size the company proposes to erect.

Employer of Driver Responsible

Court Holds Driver Agent of Baker Co., Though Driving for Car Owner

CLEVELAND, O., May 5—According to a ruling of the Court of Common Pleas of Cuyahoga County, Ohio, a garage owner is held responsible for accidents to the owner of a car, or to third parties who may be injured, in consequence of the carelessness of a hired driver in the employ of the garage.

This decision was handed down in the suit of Jones vs. Baker Motor Vehicle Co., and it appeared from the evidence that Mrs. Jones was the owner of a car which was kept by the Baker company in its garage as a boarder in the usual way. Upon her call the Baker company was in the habit of furnishing her with a driver at a fixed rate per hour, and such driver was instructed by the Baker company to drive as directed by the owner while out with the car. It appeared further that while such an employee of the Baker company was driving Mrs. Jones one evening about dark and in a drizzling rain the electric ran into a dirt wagon standing by the roadside with no light upon it. Mrs. Jones claimed injury as a result of the collision and the court charged the jury that, as a matter of law, the driver of the car was, at the time of the accident, the agent and servant of the Baker company and that if the company had not exercised due care in the selection of a careful driver, or if the driver were negligent, and such negligence caused the accident, the company was liable.

The ruling in the case is the first of its particular kind and is of great importance to the retail branch of the industry in the event it is sustained by the higher courts.

Re-Elect Allis-Chalmers Directors

MILWAUKEE, WIS., May 6—The present directors of the Allis-Chalmers Mfg. Co., this city, were re-elected at the annual meeting of the stockholders at Wilmington, Del.

The directors are: J. H. McClement of New York, chairman; Gen. O. H. Falk, O. C. Fuller, J. D. Mortimer, Gustave Pabst and Fred Vogel, Jr., of Milwaukee; Max Pam and F. O. Wetmore of Chicago; A. W. Butler, Arthur Coppell, C. W. Cox, O. L. Gubelman, R. G. Hutchins, Jr., and W. C. Potter of New York, and J. P. Winchester of Wilmington. Messrs. McClement, Falk, Mortimer, Fuller, Pabst, Vogel, Pam and Wetmore are directors elected by holders of preferred stock and the others are elected by holders of common stock.

40 Cents Per H. P. in California

New Schedule, If Adopted, Will Do Away with Blanket System

SACRAMENTO, CAL., May 7—Unless there is some slip during the present session of the state legislature, the state automobile registration act will be so amended that a fixed registration fee based on 40 cents per horsepower S. A. E. rating will be adopted. Under the present law automobiles are taxed under a blanket rating covering of from 10 to 20, 20 to 30, etc., horsepower. The adoption of this schedule will give California as high a registration fee as any state in the Union.

New Traffic Laws for New Jersey

NEWARK, N. J., May 6—New traffic laws went into effect in New Jersey today. Owners of vehicles, both horse-drawn and motor-driven, together with pedestrians, street cars and bicycles are included within their scope.

The new law was drawn up as a result of a report submitted to Governor Fielder by a special committee appointed by him to consider the subject. This committee was composed of the then motor vehicle commissioner, Job H. Lippincott, chairman; A. V. Hamburg, president of the Board of Trade in Newark, and G. B. Le Barre, commissioner of public safety of Trenton. The new law does away with a mass of conflicting and contradictory local ordinances that were a bane alike to the driver of the automobile and the horse vehicle.

One of the features of the new rules is the legal definition of who has the right-of-way at intersecting streets not operated by traffic officers. The right-of-way at such points is given to the driver of the vehicle on the right. The law also regulates the speed of horse vehicles, trolley cars and other conveyances, but does not attempt to change the present automobile speed, already covered by the motor vehicle act.

Some of the salient features of the regulations applying to all roads concerning stopping, turning, passing and crossing follow:

Headlight Glare Eliminated

Headlight glare is to be eliminated. Dimmers on electric headlights are not sufficient. Particular emphasis is laid in the new rules on the fact that all devices to do away with dazzling headlights must be permanent in their character and must not be under the control of the driver. The rules apply to vehicles, no matter whether in the city or in the country, and irrespective of whether they are licensed in this (New Jersey) or in some neighboring state.

Every driver or operator of any vehicle following any street car, when passing such street car when it is stopped to take on or discharge passengers, shall keep at least 8 feet from the right-hand running board or low step of such car.

It shall be unlawful for any person to hitch or leave standing, or to cause or permit to be hitched or left standing, any animal, or to leave standing any vehicle or animal in or upon any public street within 10 feet of a fire hydrant, unless such animal is in charge of some person capable of driving the same, or unless such vehicle is in charge of some person capable of driving or operating the same.

No vehicle shall stop or stand within the intersection of any cross street, nor within 10 feet of any cross walk or street crossing.

No vehicle shall travel at a greater speed than 6 miles an hour when passing or approaching a schoolhouse, provided signs easily visible have been placed on the highway indicating such approach.

Any person crossing a street at any place other than the crosswalk shall do so at his own risk. Nothing in this regulation, however, shall relieve the drivers of vehicles from being constantly vigilant, exercising all reasonable care to avoid injuring either persons or property.

Maxwell Test Shows High Efficiency

NEW HAVEN, CONN., May 12—A new Maxwell car has just been tested by the Sheffield Scientific School of Yale University and, according to E. H. Lockwood, assistant professor of mechanical engineering, the results compare very favorably with those made by the school on some forty other automobiles. Mr. Lockwood in his report says that the fuel efficiency is exceptionally high, and that the power at the road wheels is particularly good by comparison with the pounds of gasoline consumed in an hour. The following table gives the principal figures of the test:

Weight of car with driver	2,000 lbs.
Wind resisting area	20 sq. ft.
Rolling resistance, declutched, high	36 lbs.
Rear ratio, direct, measured	3.55 to 1
Tires, size, front and rear	30 x 3.5
Cylinders	Four, 3 5-8 x 4 1-2
Carbureter	K. D.
Ignition	Battery and Simms Magneto
Gasoline spec. grav.	0.72

Speed Miles per hour	Drawbar pull pounds	Horsepower at rear tires	Fuel miles per gallon
10.2	42.	1.2	33.8
19.8	60.	3.2	33.2
30.1	90.	7.2	23.2
40.	132.	14.1	19.3

DOVER, DEL., May 8—The Elgin Motor Car Corp. has been incorporated with a capital stock of $1,000,000. The incorporators are: F. R. Hansell, Philadelphia; G. H. B. Martin, S. C. Seymour, Camden, N. J.

Amendment Cuts Pa. License Raise

Change Made To Make Increase Average But 25 Per Cent. Instead of 50

HARRISBURG, PA., May 6—Automobile and commercial vehicle license rates in Pennsylvania will be only increased 25 per cent., according to an amendment to the Lipschutz bill, which has just been passed on second reading.

The amended bill provides for the following fees for pneumatic tire vehicles:

Horsepower	New Rates	Old Rates
Under 20	$6	$5
From 20 to 35	12	10
From 35 to 50	20	15
Over 50	30	20

FOR SOLID TIRE MOTOR VEHICLES

Pounds	New Rates	Old Rates
Under 4,000	$10	$5
From 4,000 to 5,000	15	10
From 5,000 to 10,000	20	15
From 10,000 to 15,000	25	20

New Insurance Rates in Missouri

ST. LOUIS, MO., May 7—As a result of the recently enacted Missouri fire insurance rating law, which prohibits rate-cutting, automobile owners in this state henceforth will have to pay about 50 per cent. more for insurance on their machines. The question of whether automobile fire insurance would come under the provisions of the new rating law, which was in dispute for several weeks, has just been decided in the affirmative by the State Insurance Commissioner.

Thirty-five insurance companies taking auto risks in St. Louis already have filed their rates with the Insurance Commissioner. These rates are the same as most companies have been trying to maintain for two years, but which have not been in force because of the common practice of agents of cutting rates to get the business.

The new rates will be $1.50 per $100 valuation per year on high-priced cars; $1.75 per $100 on medium-priced cars, and $2 per $100 valuation on low-priced cars. The new schedule became effective this week and it is believed that owing to the rigid provisions of the new law for the maintenance of rates no insurance company or agent will attempt rate-cutting.

4,000 New Cars for Colorado in 1915—20% Gain

DENVER, COL., May 3—Colorado promises to show an increase this year of 4,000 cars, or more than 20 per cent., over the 1914 registration, according to an estimate made by Secretary of State Ramer. Last year the total registration, including dealers' cars, was 18,433, and the returns received thus far this year have reached the 18,000 mark. Denver's

share of this number is 5,900. On account of heavy snow still blocking some of the mountain passes, the returns from several of the outside counties are coming in rather slow. But the snow is getting out of the way a little faster this year than it did last, and the new system of starting registration December 1 has also helped to bring in a larger proportion of the total registration than the returns showed at this time in 1914. Secretary Ramer has ordered a total of 22,700 license tags for 1915, and states that this number represents a conservative estimate of Colorado's total cars for this year, according to reports from county officials and sales predictions from dealers.

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34,000 Cars in Ontario

TORONTO, Ont., May 8.—Nearly 34,000 cars are now registered in Ontario, which seems amazing for only one province of the Dominion. As a matter of fact the Canadian Ford Company's output of 30,000 cars in Ontario for this year alone will be more than half as many as the cars of all makes now in Germany, 57,000, and a third as many as are in France, 90,000. It is surprising to note that there are three times as many cars in use in Ontario as in the entire Russian Empire and twice as many as in Austria. Australian registrations show 15,000 cars owned in that country, which is less than half the number of cars owned in Ontario.

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Canada Underwriters Formed

TORONTO, ONT., May 8—Writers of automobile insurance in Canada met in Toronto last week and formed the Automobile Underwriters' Assn., of Canada. Practically all the accident insurance companies were represented. The association proposes to revise the tariff of automobile insurance premiums. J. J. Durance, General Accident Insurance Co., was appointed president of the association, and W. H. Cross, secretary. The association will have offices at Toronto and Montreal.

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Automobilists Must Dim Headlights

BALTIMORE, MD., May 8—Cumberland, Md., has issued orders that all motorists must dim the lights on their machines while in the city limits.

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Cartercar Men Form New Connections

DETROIT, MICH., May 10—George Reason, manager of the Detroit branch of the Cartercar company ever since it was started about 9 years ago, has taken over the Addison Garage.

L. B. Fast, who had charge of the city sales of the local Cartercar branch, has taken a position with the Oakland Motor Car Co.

Automobile Exhibits at Exposition Occupy 80,000 Square Feet of Space

Accessory Displays Fill 2,000 Square Feet More and 60,000 Feet Held in Reserve—Also 60,000 Feet for Motor Trucks, Latter Is Wholly Unoccupied

SAN FRANCISCO, CAL., May 6—In the Palace of Transportation of the Panama-Pacific Exposition, a 7-acre building, is an automobile exhibit using about 80,000 square feet of space. In addition, there are 2,500 square feet of accessory displays and 3,500 square feet used by the motorcycle interests.

Nearly 60,000 square feet is still held in reserve in the automobile section and there also is a motor truck building, with 60,000 square feet, which is wholly unoccupied.

Blythe H. Henderson, chief of exhibits of the transportation palace, left yesterday for the East to interest gasoline and electric car manufacturers in filling the large amount of reserve space.

Most of the exhibits already installed are from the manufacturers. In a few cases San Francisco dealers are sharing in the expense or are supplying representatives. Several dealers are carrying space outright but hope to be reimbursed partially by the factories later.

All representatives in the exhibits report a fair interest, which they say is above expectations for this early season of the exposition. No sales are closed on the grounds on account of the provision of the space contract which requires a 25 per cent. bonus to the exposition for every transfer of money within the exposition.

The price of space is $1.50 a square foot, which is complete for the year. This pays not only for rental, but for janitor service, lights and a certain amount of decoration of the automobile section of the palace.

This decoration includes relief maps in the upper walls, three of which—the Lincoln Highway, the Meridian Highway and the Trail to Sunset—are done elaborately, from terminus to terminus, a great amount of adjacent country being shown. Ornamental trees also are supplied and an oiled linoleum.

The most ambitious exhibit is by the Ford Motor Co., which has a miniature assembly plant. Eighteen complete cars are put together from 2 until 5 o'clock every afternoon, or at the rate of one every 10 minutes. These are moved along in the assembly processes by a conveyor and finally are driven off under their own power to a parking space outside.

Awards of merit are to be given cars in the exhibits in the fall by a jury of experts to be named later. This jury, to be composed largely of members of the S. A. E., will formulate its own rules. Some judges have already been chosen.

Carnegie Engineering Promoters Held for Mail Fraud

KALAMAZOO, MICH., May 7—United States officers today arrested Robert F. Norwalk, vice-president of the Carnegie Engineering Co., of New York, which is supposed to have been making the Carnegie car, but which, according to the post office authorities, has been using the mails for a fraudulent purpose.

While the vice-president of the company was being arrested here, the president, William J. Bailey, was arrested in New York for the same reason.

In its literature the company advertised the Carnegie car at a price of $595 f.o.b. Pittsburgh, Pa., and it was so worded as to give an impression, it is claimed, that the Carnegie Steel Co., Pittsburgh, was interested in the matter. By the clever wording of the letters and advertising matter, the engineering company, it is claimed, received deposits from a very large number of dealers. Fifty dollars for every car ordered was generally required to show the good faith of the dealer. One dealer in this way made a deposit of $1,250—for fifty cars.

When interviewed by a representative of THE AUTOMOBILE, Bailey, who is out on bail, denied this and stated that his contracts called for demonstrator cars to be ready August 1. This he said would have been done. Kalamazoo agents of the company are now endeavoring to rush a finished car to New York to show at the trial as evidence that the company intended to deliver cars.

The specific instance cited by the government is an intent to defraud the Hudson-Phillips Motor Car Co., St. Louis, Mo.

The capital stock of the Carnegie Engineering Co. is supposed to have been $1,000,000. Claims were made that it had the largest automobile plant in the world, supposedly in Kalamazoo. A local concern received an order to assemble five cars for the company, but last week, so the report goes, the engineering company had to relinquish receipt of several boxes of parts, owing to lack of funds to pay the express company's charges.

40 Cents Per H. P. in California

New Schedule, If Adopted, Will Do Away with Blanket System

SACRAMENTO, CAL., May 7—Unless there is some slip during the present session of the state legislature, the state automobile registration act will be so amended that a fixed registration fee based on 40 cents per horsepower S. A. E. rating will be adopted. Under the present law automobiles are taxed under a blanket rating covering of from 10 to 20, 20 to 30, etc., horsepower. The adoption of this schedule will give California as high a registration fee as any state in the Union.

New Traffic Laws for New Jersey

NEWARK, N. J., May 6—New traffic laws went into effect in New Jersey today. Owners of vehicles, both horse-drawn and motor-driven, together with pedestrians, street cars and bicycles are included within their scope.

The new law was drawn up as a result of a report submitted to Governor Fielder by a special committee appointed by him to consider the subject. This committee was composed of the then motor vehicle commissioner, Job H. Lippincott, chairman; A. V. Hamburg, president of the Board of Trade in Newark, and G. B. Le Barre, commissioner of public safety of Trenton. The new law does away with a mass of conflicting and contradictory local ordinances that were a bane alike to the driver of the automobile and the horse vehicle.

One of the features of the new rules is the legal definition of who has the right-of-way at intersecting streets not operated by traffic officers. The right-of-way at such points is given to the driver of the vehicle on the right. The law also regulates the speed of horse vehicles, trolley cars and other conveyances, but does not attempt to change the present automobile speed, already covered by the motor vehicle act.

Some of the salient features of the regulations applying to all roads concerning stopping, turning, passing and crossing follow:

Headlight Glare Eliminated

Headlight glare is to be eliminated. Dimmers on electric headlights are not sufficient. Particular emphasis is laid in the new rules on the fact that all devices to do away with dazzling headlights must be permanent in their character and must not be under the control of the driver. The rules apply to vehicles, no matter whether in the city or in the country, and irrespective of whether they are licensed in this (New Jersey) or in some neighboring state.

Every driver or operator of any vehicle following any street car, when passing such street car when it is stopped to take on or discharge passengers, shall keep at least 8 feet from the right-hand running board or low step of such car.

It shall be unlawful for any person to hitch or leave standing, or to cause or permit to be hitched or left standing, any animal, or to leave standing any vehicle or animal in or upon any public street within 10 feet of a fire hydrant, unless such animal is in charge of some person capable of driving the same, or unless such vehicle is in charge of some person capable of driving or operating the same.

No vehicle shall stop or stand within the intersection of any cross street, nor within 10 feet of any cross walk or street crossing.

No vehicle shall travel at a greater speed than 6 miles an hour when passing or approaching a schoolhouse, provided signs easily visible have been placed on the highway indicating such approach.

Any person crossing a street at any place other than the crosswalk shall do so at his own risk. Nothing in this regulation, however, shall relieve the drivers of vehicles from being constantly vigilant, exercising all reasonable care to avoid injuring either persons or property.

Maxwell Test Shows High Efficiency

NEW HAVEN, CONN., May 12—A new Maxwell car has just been tested by the Sheffield Scientific School of Yale University and, according to E. H. Lockwood, assistant professor of mechanical engineering, the results compare very favorably with those made by the school on some forty other automobiles. Mr. Lockwood in his report says that the fuel efficiency is exceptionally high, and that the power at the road wheels is particularly good by comparison with the pounds of gasoline consumed in an hour. The following table gives the principal figures of the test:

Weight of car with driver	2,000 lbs.
Wind resisting area	20 sq. ft.
Rolling resistance, declutched, high	36 lbs.
Rear ratio, direct, measured	3.55 to 1
Tires, size, front and rear	30 x 3.5
Cylinders	Four, 3 5-8 x 4 1-2
Carbureter	K. D.
Ignition	Battery and Simms Magneto
Gasoline spec. grav.	0.72

Speed Miles per hour	Drawbar pull pounds	Horsepower at rear tires	Fuel miles per gallon
10.2	42.	1.2	33.8
19.8	60.	3.2	33.2
30.1	90.	7.2	23.2
40.	132.	14.1	19.3

DOVER, DEL., May 8—The Elgin Motor Car Corp. has been incorporated with a capital stock of $1,000,000. The incorporators are: F. R. Hansell, Philadelphia; G. H. B. Martin, S. C. Seymour, Camden, N. J.

Amendment Cuts Pa. License Raise

Change Made To Make Increase Average But 25 Per Cent. Instead of 50

HARRISBURG, PA., May 6—Automobile and commercial vehicle license rates in Pennsylvania will be only increased 25 per cent., according to an amendment to the Lipschutz bill, which has just been passed on second reading.

The amended bill provides for the following fees for pneumatic tire vehicles:

Horsepower	New Rates	Old Rates
Under 20	$6	$5
From 20 to 35	12	10
From 35 to 50	20	15
Over 50	30	20

FOR SOLID TIRE MOTOR VEHICLES

Pounds	New Rates	Old Rates
Under 4,000	$10	$5
From 4,000 to 5,000	15	10
From 5,000 to 10,000	20	15
From 10,000 to 15,000	25	20

New Insurance Rates in Missouri

ST. LOUIS, MO., May 7—As a result of the recently enacted Missouri fire insurance rating law, which prohibits rate-cutting, automobile owners in this state henceforth will have to pay about 50 per cent. more for insurance on their machines. The question of whether automobile fire insurance would come under the provisions of the new rating law, which was in dispute for several weeks, has just been decided in the affirmative by the State Insurance Commissioner.

Thirty-five insurance companies taking auto risks in St. Louis already have filed their rates with the Insurance Commissioner. These rates are the same as most companies have been trying to maintain for two years, but which have not been in force because of the common practice of agents of cutting rates to get the business.

The new rates will be $1.50 per $100 valuation per year on high-priced cars; $1.75 per $100 on medium-priced cars, and $2 per $100 valuation on low-priced cars. The new schedule became effective this week and it is believed that owing to the rigid provisions of the new law for the maintenance of rates no insurance company or agent will attempt rate-cutting.

4,000 New Cars for Colorado in 1915—20% Gain

DENVER, COL., May 3—Colorado promises to show an increase this year of 4,000 cars, or more than 20 per cent., over the 1914 registration, according to an estimate made by Secretary of State Ramer. Last year the total registration, including dealers' cars, was 18,433, and the returns received thus far this year have reached the 18,000 mark. Denver's

share of this number is 5,900. On account of heavy snow still blocking some of the mountain passes, the returns from several of the outside counties are coming in rather slow. But the snow is getting out of the way a little faster this year than it did last, and the new system of starting registration December 1 has also helped to bring in a larger proportion of the total registration than the returns showed at this time in 1914. Secretary Ramer has ordered a total of 22,700 license tags for 1915, and states that this number represents a conservative estimate of Colorado's total cars for this year, according to reports from county officials and sales predictions from dealers.

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34,000 Cars in Ontario

TORONTO, Ont., May 8.—Nearly 34,000 cars are now registered in Ontario, which seems amazing for only one province of the Dominion. As a matter of fact the Canadian Ford Company's output of 30,000 cars in Ontario for this year alone will be more than half as many as the cars of all makes now in Germany, 57,000, and a third as many as are in France, 90,000. It is surprising to note that there are three times as many cars in use in Ontario as in the entire Russian Empire and twice as many as in Austria. Australian registrations show 15,000 cars owned in that country, which is less than half the number of cars owned in Ontario.

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Canada Underwriters Formed

TORONTO, ONT., May 8—Writers of automobile insurance in Canada met in Toronto last week and formed the Automobile Underwriters' Assn., of Canada. Practically all the accident insurance companies were represented. The association proposes to revise the tariff of automobile insurance premiums. J. J. Durance, General Accident Insurance Co., was appointed president of the association, and W. H. Cross, secretary. The association will have offices at Toronto and Montreal.

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Automobilists Must Dim Headlights

BALTIMORE, MD., May 8—Cumberland, Md., has issued orders that all motorists must dim the lights on their machines while in the city limits.

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Cartercar Men Form New Connections

DETROIT, MICH., May 10—George Reason, manager of the Detroit branch of the Cartercar company ever since it was started about 9 years ago, has taken over the Addison Garage.

L. B. Fast, who had charge of the city sales of the local Cartercar branch, has taken a position with the Oakland Motor Car Co.

Automobile Exhibits at Exposition Occupy 80,000 Square Feet of Space

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Accessory Displays Fill 2,000 Square Feet More and 60,000 Feet Held in Reserve—Also 60,000 Feet for Motor Trucks, Latter Is Wholly Unoccupied

SAN FRANCISCO, CAL., May 6—In the Palace of Transportation of the Panama-Pacific Exposition, a 7-acre building, is an automobile exhibit using about 80,000 square feet of space. In addition, there are 2,500 square feet of accessory displays and 3,500 square feet used by the motorcycle interests.

Nearly 60,000 square feet is still held in reserve in the automobile section and there also is a motor truck building, with 60,000 square feet, which is wholly unoccupied.

Blythe H. Henderson, chief of exhibits of the transportation palace, left yesterday for the East to interest gasoline and electric car manufacturers in filling the large amount of reserve space.

Most of the exhibits already installed are from the manufacturers. In a few cases San Francisco dealers are sharing in the expense or are supplying representatives. Several dealers are carrying space outright but hope to be reimbursed partially by the factories later.

All representatives in the exhibits report a fair interest, which they say is above expectations for this early season of the exposition. No sales are closed on the grounds on account of the provision of the space contract which requires a 25 per cent. bonus to the exposition for every transfer of money within the exposition.

The price of space is $1.50 a square foot, which is complete for the year. This pays not only for rental, but for janitor service, lights and a certain amount of decoration of the automobile section of the palace.

This decoration includes relief maps in the upper walls, three of which—the Lincoln Highway, the Meridian Highway and the Trail to Sunset—are done elaborately, from terminus to terminus, a great amount of adjacent country being shown. Ornamental trees also are supplied and an oiled linoleum.

The most ambitious exhibit is by the Ford Motor Co., which has a miniature assembly plant. Eighteen complete cars are put together from 2 until 5 o'clock every afternoon, or at the rate of one every 10 minutes. These are moved along in the assembly processes by a conveyor and finally are driven off under their own power to a parking space outside.

Awards of merit are to be given cars in the exhibits in the fall by a jury of experts to be named later. This jury, to be composed largely of members of the S. A. E., will formulate its own rules. Some judges have already been chosen.

Carnegie Engineering Promoters Held for Mail Fraud

KALAMAZOO, MICH., May 7—United States officers today arrested Robert F. Norwalk, vice-president of the Carnegie Engineering Co., of New York, which is supposed to have been making the Carnegie car, but which, according to the post office authorities, has been using the mails for a fraudulent purpose.

While the vice-president of the company was being arrested here, the president, William J. Bailey, was arrested in New York for the same reason.

In its literature the company advertised the Carnegie car at a price of $595 f.o.b. Pittsburgh, Pa., and it was so worded as to give an impression, it is claimed, that the Carnegie Steel Co., Pittsburgh, was interested in the matter. By the clever wording of the letters and advertising matter, the engineering company, it is claimed, received deposits from a very large number of dealers. Fifty dollars for every car ordered was generally required to show the good faith of the dealer. One dealer in this way made a deposit of $1,250—for fifty cars.

When interviewed by a representative of THE AUTOMOBILE, Bailey, who is out on bail, denied this and stated that his contracts called for demonstrator cars to be ready August 1. This he said would have been done. Kalamazoo agents of the company are now endeavoring to rush a finished car to New York to show at the trial as evidence that the company intended to deliver cars.

The specific instance cited by the government is an intent to defraud the Hudson-Phillips Motor Car Co., St. Louis, Mo.

The capital stock of the Carnegie Engineering Co. is supposed to have been $1,000,000. Claims were made that it had the largest automobile plant in the world, supposedly in Kalamazoo. A local concern received an order to assemble five cars for the company, but last week, so the report goes, the engineering company had to relinquish receipt of several boxes of parts, owing to lack of funds to pay the express company's charges.

17,084 Carloads of Automobiles Shipped in April—N. A. C. C. Meets

Month's Shipments of Cars and Trucks Greatest in History of the Industry—Investigate Jitney Buses—Future Seems Assured—To Encourage Development

DETROIT, MICH., May 5—Automobile shipments for April of this year were 17,084 freight carloads, the greatest number in the history of the industry. This fact was brought out at the meeting of the board of directors of the National Automobile Chamber of Commerce, Inc., held here this morning, and preceding the opening of the truck convention. In giving these record shipment figures to the meeting, the traffic committee reported that this number was an increase of nearly 25 per cent. over April of last year, when 14,122 carloads of motor vehicles were shipped.

In consequence of the shipping activity of the past few months, which has no parallel in the industry's history, Wm. E. Metzger, chairman of the traffic committee, stated that the unprecedented demand for freight cars was being felt by the railroads, which have asked the manufacturers to use every effort to have the special automobile cars returned promptly.

Among other matters, the N. A. C. C. took up the matter of jitney buses and is investigating them. Their future seems assured and they have opened up a new field for commercial cars. Ways and means of encouraging this field and showing up just what the buses will really do were discussed, and such matters as insurance, speed, carrying capacity and other considerations of vital importance to the future of the traffic were referred to a special committee appointed for the purpose.

Various reports of committees on good roads, patents, legislation and commercial vehicles were heard, and special mention was made of the opening up of the Yellowstone Park to automobilists August 1.

The meeting was held here in order to give all an opportunity to attend the truck convention, it ordinarily being held in New York. W. C. Leland presided, and others in attendance were Hugh Chalmers, Alvan Macauley, W. E. Metzger, R. D. Chapin, C. C. Hanch, H. H. Rice, W. T. White, C. W. Churchill, Col. Geo. Pope, Thomas Henderson, and Alfred Reeves.

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Dividends Declared

HARTFORD, CONN., May 8—Pratt & Whitney Co., regular quarterly dividend of 1½ per cent., preferred stock; payable May 15. Books closed May 6 and reopen May 17.

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Few Changes in Market

NEW YORK CITY, May 10—Market prices last week were steadier with the usual changes. There was a small demand in the metal markets yesterday and a less confident tone among the selling interests. The largest producing interests are still asking 19 cents delivered 30 days for electrolytic copper. Shipments of copper are going forward a little more freely. Tin showed less demand with freer offerings of nearby and future positions. Yesterday the metal was weaker than on Saturday, but of course considerably higher than on Friday. Lead was stronger in tone at the closing on Monday and with a better offering.

The crude rubber market yesterday developed a somewhat better inquiry and was more steady. Manufacturers continued to restrict their purchases to comparatively small lots, but the demand for such quantities showed some increase. Fine Up-River Para quoted at 60 cents after having a short drop to 59 on Friday and Saturday. The market in London is dull with plantation rubber easier. Shipments are coming in regularly from London, Liverpool and Singapore.

The oils and lubricants markets were steady with a moderate demand in all the products. Linseed oil showed a gain this week of 2 cents. The rest of the oils remained unchanged.

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Goodrich Plans Addition of $1,000,000 Building

AKRON, O., May 8—The B. F. Goodrich Co. contemplates the erection of a $1,000,000 factory building during the present summer. The structure, which will be the last word in factory construction, will be erected on South Main street. Plans for the structure are being prepared by the Osbourn Engineering Co., Cleveland.

It is planned to use a portion of the building for a warehouse until a later date, when it will be made into a factory proper with machinery installed. The Goodrich company recently purchased a strip of ground along the canal near the present factory, and at that time it was rumored that a large addition to the plant would be erected.

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Continental Motor Plans—Addition to Muskegon Plant

MUSKEGON, MICH., May 10—The Continental Motor Mfg. Co. is planning the erection of a new three-story building on North Terrace street, the new building to be used for crating and packing purposes. The addition will be the largest the company has built in a number of years.

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Buick to Enlarge Plant

FLINT, MICH., May 10—The Buick Motor Co. was given a permit last week for a two-and-one-half-story factory addition which is to cost $22,500.

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Ford to Build 47,813 Cars Per Month to Aug. 1

DETROIT, MICH., May 10—Between August 1, 1914, and April 1, 1915, that is during 9 months of the fiscal year of the Ford Motor Co., agents throughout the country have received 156,561 complete cars, which is at the rate of 17,395 per month. This means that during the remaining 3 months of the fiscal year the company must build 143,439 cars, or an average of 47,813 per month, in order to complete the 300,000 cars to be made in the fiscal year. This is quite likely to be accomplished inasmuch as during

Daily Market Reports for the Past Week

Material.	Tues.	Wed.	Thurs.	Fri.	Sat.	Mon.	Week's Changes
Antimony	.33	.34½	.34	.34	.34	.34	+.01
Beams & Channels, 100 lbs.	1.31	1.31	1.31	1.31	1.31	1.31	.....
Bessemer Steel, ton	19.00	19.00	19.00	19.00	19.00	19.00	.....
Copper, Elec., lb.	.18⅝	.18¾	.18¾	.18⅞	.18¾	.18¾	+.00⅛
Copper, Lake, lb.	.19	.19	.19	.19	.19	.19	.....
Cottonseed Oil, bbl.	6.57	6.50	6.45	6.39	6.30	6.30	—.27
Cyanide Potash, lb.	.23	.23	.23	.23	.23	.23	.....
Fish Oil, Menhaden, Brown	.41	.41	.41	.41	.41	.41	.....
Gasoline, Auto, bbl.	.12	.12	.12	.12	.12	.12	.....
Lard Oil, prime	.90	.90	.90	.90	.90	.90	.....
Lead, 100 lbs.	4.15	4.15	4.15	4.15	4.15	4.20	+.05
Linseed Oil	.65	.65	.67	.67	.67	.67	+.02
Open-Hearth Steel, ton	19.00	19.00	19.00	19.00	19.00	19.00	.....
Petroleum, bbl., Kans., crude	.40	.40	.40	.40	.40	.40	.....
Petroleum, bbl., Pa., crude	1.35	1.35	1.35	1.35	1.35	1.35	.....
Rapeseed Oil, refined	.82	.82	.82	.82	.82	.82	.....
Rubber, Fine Up-River, Para	.60	.60	.60	.59	.59	.60	.....
Silk, raw, Ital.	3.90	..	3.90	..	..	3.90	.....
Silk, raw, Japan	3.55	..	3.52½	..	..	3.55	.....
Sulphuric Acid, 60 Baume	.90	.90	.90	.90	.90	.90	.....
Tin, 100 lb.	39.25	39.00	39.00	39.50	41.50	40.75	+1.00
Tire scrap	.04¾	.04¾	.05	.05	.05	.05	+.00¼

April the production was 46,510 cars. In addition to the 156,561 cars complete cars shipped to the agents, the various assembling plants throughout the country have assembled about 40,000 cars during the period of August 1, 1914, to April 1, 1915.

Mansfield Tire Expands

MANSFIELD, O., May 10—The Mansfield Tire and Rubber Co. is working night and day. The work of getting the new plant at Columbiana, O., ready for operation is being rushed and it is hoped in that way to relieve the congestion at the Mansfield plant.

At a recent meeting of the directors of the company, it was decided to erect a four-story addition to the southeast of the present structure. The addition will be 100 by 41 feet with a completed basement. A lot of new machinery has also been purchased which will be installed as soon as possible.

Princess Enlarges Plant—1916 Car Ready

DETROIT, MICH., May 8—The Princess Motor Car Co., this city, has recently added 5,000 square feet of floorspace to its plant. The force of twelve men is to be gradually increased and it is expected that ten cars a day will be made by the end of this month. Recently the company completed its first 1916 model, known as the Princess 30, which is listed at $695. An order for sixty-five model C cars, at $495, was received recently from a dealer in Belfast, Ireland, and filled at once.

War Rumors Affect Market Issues

Heavy Liquidation Follows Sinking of Lusitania—Few Gains Reported

NEW YORK CITY, May 8—Automobile securities followed a downward course last week on account of international questions. The market received a bad shock from news of the sinking of the Lusitania. There was a rush to sell long stocks, especially in stocks which led the recent rise. Prices are certain to move irregularly until the direct and indirect effects of the disaster can be more clearly diagnosed.

Ajax-Grieb, Firestone, Goodyear, Willys-Overland, J. I. Case and Chalmers issues were the only ones to show gains for the week. The largest rises were in tire issues, Ajax-Grieb and Firestone common, going up 15 and 20 points respectively. Chalmers common went up 3 points. The rest were 1-point gains.

Studebaker's loss was 10 points. General Motors was one of the issues that did not recover. Before the decline started it was selling at 143 3-4, compared with 144 1-8, the closing price on Thursday. The last sale was 138. Goodrich advanced early on Friday, but in the afternoon the price declined from 48 1-2 to 39 3-4. Its recovery was 3 1-4 points.

Detroit quotations showed a sympathetic decline, the drops, however, being on a smaller scale than those in the local exchange. Regal preferred in the inactive stocks showed a 5-point gain, the largest. Chalmers common and preferred went up 1-2 and 1-point respectively.

Puritan Machine Buys Crescent

DETROIT, MICH., May 10—The Puritan Machine Co., Detroit, has made its sixty-fourth purchase of the parts of automobile manufacturers. The sixty-fourth purchase is that of the Crescent Motor Car Co., Cincinnati, O. The sixty-third purchase was that of the Carthage Motor Car Co., Carthage, O.

Speedwell Plant Sold

DAYTON, O., May 6—The plant of the Speedwell Motor Car Co., which was placed in the hands of a receiver on March 1, has been sold to the W. M. Pattison Supply Co. The plant was offered, it was reported, at $150,000. The Speedwell assets were purchased by the Puritan Machine Co., Detroit, Mich., in April.

$600 Offer for Church-Field

DETROIT, MICH., May 8—The Union Trust Co., assignee for the Church-Field Motor Co., Sibley, Mich., has been offered $600 for the remaining assets. Permission has been asked Judge Murphy to accept the offer.

Nelson with McGraw

EAST PALESTINE, O., May 10—R. G. Nelson, formerly manager of the Nordyke & Marmon Co., Chicago branch, is now with the sales department of the McGraw Tire and Rubber Co., this city.

Automobile Securities Quotations on New York and Detroit Exchanges

	1914 Bid	1914 Asked	1915 Bid	1915 Asked	Wk's Ch'ges
Ajax-Grieb Rubber Co. com	215	..	300	..	+15
Ajax-Grieb Rubber Co. pfd	99	..	101	..	+1
Aluminum Castings pfd	98	100	98	100	..
J. I. Case pfd	80½	82½	81	87	+1
Chalmers Motor Company com	80	86	93	96	+3
Chalmers Motor Company pfd	90	91½	94	98	—1
Electric Storage Battery Co	..	..	51	52	—1
Firestone Tire & Rubber Co. com	285	290	485	..	+20
Firestone Tire & Rubber Co. pfd	106	109	110	112½	..
General Motors Company com	78	80	138	140	—5
General Motors Company pfd	90	92	97	99	—4
B. F. Goodrich Company com	25¾	26	43	44	—7
B. F. Goodrich Company pfd	89¾	90½	101½	103	— ½
Goodyear Tire & Rubber Co. com	173	178	245	255	—17
Goodyear Tire & Rubber Co. pfd	97	98½	105	106½	+ ½
Gray & Davis Inc. pfd	95	102½	..	..	..
International Motor Co. com	..	5	10	12	—3½
International Motor Co. pfd	..	15	25	30	—4
Kelly-Springfield Tire Co. com	..	..	116	129	—19
Kelly-Springfield Tire Co. 1st pfd	..	..	83	86	..
Kelly-Springfield Tire Co. 2nd pfd	..	..	130	140	..
Maxwell Motor Company com	8¾	9¼	46½	47½	—5½
Maxwell Motor Company 1st pfd	39½	40½	81	83	—3
Maxwell Motor Company 2nd pfd	14¾	15¼	38	39	—2
Miller Rubber Company com	..	..	180	188	..
Miller Rubber Company pfd	..	..	104	105	..
New Departure Mfg. Co. com	103	..	..	..	..
New Departure Mfg. Co. pfd	94	98	..	..	..
Packard Motor Car Co. com	103	..	105	..	..
Packard Motor Car Co. pfd	94	98	95	100	—4
Peerless Motor Car Co. com	18	25	20	22	..
Peerless Motor Car Co. pfd	..	70	..	55	..
Portage Rubber Co. com	..	30	35	38	..
Portage Rubber Co. pfd	..	85	85	88	..
*Reo Motor Truck Company	8¾	9½	14½	16	..
*Reo Motor Car Company	24	27	31	33	—1
Splitdorf Electric Co. pfd	..	50	..	..	..
Stewart-Warner Speed. Corp. com	48½	50	68	69	—1½
Stewart-Warner Speed. Corp. pfd	98½	99½	103	105	..
Studebaker Corporation com	32½	33	66	67	—10
Studebaker Corporation pfd	87	89	101	103	..
Swinehart Tire & Rubber Co.	60	65	80	90	—1
Texas Company	140	142	129	131	—8
U. S. Rubber Co. com	57	57¾	60	62	—10
U. S. Rubber Co. pfd	101	102	106	107½	—2
Vacuum Oil Company	218	222	213	215	—3
White Company pfd	107	110	103	108	..
Willys-Overland Co. com	64	66	117	119	+1
Willys-Overland Co. pfd	88	92	100	102	..

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	1914 Bid	1914 Asked	1915 Bid	1915 Asked	Wk's Ch'ges
Chalmers Motor Co. com	84	..	..	95	+ ½
Chalmers Motor Co. pfd	90¾	92½	93	98	+1
Centinental Motor Co. com	150	180	170	185	..
Continental Motor Co. pfd	..	80	82	85½	..
General Motors Co. com	78	80	136	144	—6½
General Motors Co. pfd	90	92	98	100	—2
Maxwell Motor Co. com	8¾	9¼	45	49	—6½
Maxwell Motor Co. 1st pfd	39	40	80	82½	—3½
Maxwell Motor Co. 2nd pfd	14½	15	36	38½	—4
Packard Motor Car Co. com	103	..	103	..	..
Packard Motor Car Co. pfd	94	98	97	100½	+2
*Reo Motor Car Co	25½	26	31	32¾	..
*Reo Motor Truck Co	8¾	9½	..	15¾	+ ¼
Studebaker Corp. com	..	..	66	70	—10½
Studebaker Corp. pfd	..	..	100	102	—1

INACTIVE STOCKS

*Atlas Drop Forge Co	..	21	..	26	..
Ford Motor Co. of Canada	..	560	700	..	..
Kelsey Wheel Co	..	195	195	..	..
*W. K. Prudden Co	..	21	19½	21	+ ½
Regal Motor Car Co. pfd	..	35	..	25	+5

BONDS

General Motors, notes 6's, 1915	101	102	..	..	..
Packard Motor Co. 5's, 1916	95	98½	98¼	..	..

*Par value $10, all others $100 par value.

Annunciators for Tacoma

Speedway Is Now Three-Quarters Completed — Eight Entries for July 4 and 5

TACOMA, WASH., May 10—George D. Dunn, secretary of the Tacoma Speedway Assn., states that work on the track is progressing nicely with practically three-fourths completed. The entire planking will be finished about May 20. An innovation the Tacoma Association will try out is the installation of annunciators to announce to the spectators instead of the ordinary method of having a man talk incoherently through a megaphone. The scheme involves a megaphone with a diaphragm in each section of the grandstand and at four points in the parking spaces, making seventeen in all. These will run to four telephones which will be so arranged that they can all be spoken into by one man. Thus, at any time during the races, announcement of the positions of the cars and other interesting events can be quickly conveyed to all parts of the track.

Entries are as follows:

Bob Burman	Peugeot
Earl Cooper	Stutz
Eddie Pullen	Mercer
Guy Ruckstell	Mercer
Hoe Thomas	Mercer
Dave Lewis	Stutz
Wilbur De Alene	Car unnamed
Jim Parson	Parsons' Special

Three Briscoe Racing Cars

JACKSON, MICH., May 12—The Briscoe Motor Co. is going to enter the racing field with three specially built cars which they hope to have completed in July and to enter them in track events during the fall. Two of the cars will be built to meet the 300 cubic inches piston displacement and the third will be a free-for-all type. These cars will embody some of the standard Briscoe features of construction but in general will be racing creations.

Entry Blanks for Elgin

CHICAGO, ILL., May 8—Entry blanks for the annual Elgin road races, scheduled this year for August 20 and 21, have been sent out by George Ballou, chairman of the contest board of the Chicago Automobile Club, which will co-operate with the Elgin Road Racing Assn. in the promotion of the events.

The prize money for the two races, each 301 miles in distance, will total $6,000 as last year, and the purse for each event will be $3,000. The race for the Chicago Automobile Club cup will be run Friday and the contest for the Elgin trophy Saturday.

For this year's speed carnival the piston displacement of the competing cars has been reduced. The Elgin trophy race, formerly a free-for-all, will be for 450-cubic inch cars and the C.A.C. cup event is limited to machines that cube 300 inches instead of 450 inches as formerly.

The contract for the joint promotion of the races was signed yesterday. The course has been greatly improved since last season, having been sacrificed and rolled and about 400 wagonloads of boulders removed.

Eight-Cylinder Romano Stars on Portland Track

PORTLAND, ORE., May 8—The Rose City Speedway was the scene of the first race meet in the Northwest on May 1 and 2 and a record for its 1-mile circular dirt track was established by Charles Latta, of Seattle, when he sent the eight-cylinder Romano across the final lap in 9 minutes and 11 seconds after the start of the race.

Another Seattle car, a Velie, driven by Fred Barsby, won the 10-mile Oregon vs. Washington event for class B cars in 10 minutes 15 seconds, and the 10-mile free-for-all for class B cars in 10 minutes 13 seconds.

Only three cars entered the Portland special event—F. V. Forbes' Buick, Billy Smith's Marmon, and C. N. Bankhead's Pope Special. Forbes won, covering the 15 miles in 16 minutes and 15 seconds.

Lightning tire changes in the pits, mishaps and near-accidents on curves and the masterly driving on the part of Jim Parsons, a hard luck loser, furnished the thrills at the second day's races.

So far as the winnings were concerned, Schneider's Special gobbled up the majority of the events by winning the two class A events for 10 and 40 miles, respectively, and Fred Barsby fortified the superiority he had asserted over the class B cars on the previous day by winning the Oregon vs. Washington free-for-all.

Upwards of 3,000 enthusiasts were in attendance at the two days of racing. The meet was held under the management of the Northwest Automobile Assn. The track was pronounced to be in the best possible condition by H. L. Keats, A. A. A. representative in Oregon.

More Sunbeams for Chicago

CHICAGO, ILL., May 8—Two additional Sunbeam entries, to be driven by Harry Grant and Carl Limberg, were received today for the 500-mile race to be run over the new Chicago speedway June 19. They are the same six-cylinder cars that have been nominated at Indianapolis and are owned by the Fortuna Racing Team, Inc., of New York, which purchased them recently from William Zeigler.

Two other Sunbeams have been named for the Chicago race. They are backed by the Sunbeam factory and in charge of Porporato, the Italian driver, who will campaign them in America this season.

The Illinois Central railroad this week began work on a $75,000 terminal station at the entrance of the local speedway. The company anticipates handling a crowd of 75,000 persons in a little more than 2 hours. In a conference with David F. Reid, president of the speedway association, representatives of other railroads agreed to support the project and to run special trains to and from Chicago on the day of the race.

Two officials already have been selected for the inaugural classic on the new track. Harry Vissering, president of the Chicago Automobile Club in 1914, will be referee, and Fred J. Wagner, starter.

Automobile Parade for San Francisco

SAN FRANCISCO, CAL., April 29—One of the results of the organization of the Transportation Club among the automobile men and other exhibitors in the Palace of Transportation of the Panama-Pacific exposition, is a parade planned for Transportation day, May 21.

The club was inspired by the automobile men. The parade committee is dominated by them. The governing idea of the parade is the evolution of transportation and all varieties are to be shown, with the jitney bus as the culmination of the development.

Name Stutz and Peugeot Drivers for Indianapolis

INDIANAPOLIS, IND., May 11—The Stutz Motor Car Co. has named the drivers of its three cars in the coming 500-mile race on May 29. They are Gil Anderson, Earl Cooper, Howard Wilcox and John Aitken.

Caleb Bragg and George Babcock have been named to complete the Peugeot team with Resta, already nominated. Both Babcock and Galvin have arrived in the city and have started practicing.

Chassagne and Porporato, Sunbeam drivers, are on their way to this country. Coatalen, who was originally scheduled to drive, was unable to get away because of war business.

John De Palma has practically finished rebuilding Rene Thomas' Delage and is now putting the car through its initial track trials. Many of the cars have been out for practice. Rickenbacher, in the Maxwell, made a lap in 1:35 or nearly 95 miles per hour.

A controversy has arisen as a result of the Burman and Harroun entries. It seems that Harroun intends to court disqualification for his Harroun special, on the ground that it is really a Maxwell, and, therefore, ineligible under the rule that "no more than three cars of any one make may start in any race." Burman has changed the name of his car from Burman Special to Burman Peugeot.

San Francisco Jitney Men and City Authorities in Complete Accord

Even in Passage of Exceedingly Strict Regulating Ordinance—Association, with 1,300 Members, Organized Along Union Lines—Jitneys Cut Trolley Revenue

SAN FRANCISCO, CAL., May 6—The jitney situation is unique in this city, for the reason that there is complete harmony between jitney association and city government, even in the passage of an ordinance that would be regarded as too stringent in some places.

Here is a city that may be regarded as the jitney metropolis. Certainly there are many more cars in operation here, with a sturdier controlling body, than elsewhere in the country.

A Break Threatened

For its favorable attitude toward this ordinance, the jitney organization has had to face the actuality of a second association, whose twenty-two members are warring against the regulating measure, which has passed the board of supervisors and now awaits the mayor's signature, which he has indicated that he will sign.

The San Francisco Jitney Bus Assn., with about 1,300 members, has been organized along union lines by union organizers and probably is one of the strongest jitney associations in the country. The membership roll is growing constantly and card No. 1,650 has been passed. However, it is said that more than 300 have dropped out since the association organized in January. A constant check is kept on members by two business managers, or walking delegates, who are out on the routes every day.

Charles N. Black, vice-president and general manager of the United Railroads of San Francisco, advises the representative of THE AUTOMOBILE that:

"Our gross receipts are approximately 10 per cent. less than during the corresponding period last year. The principal lines affected are those operating from the ferry out Market street, which is the Broadway of San Francisco.

"It is difficult to state how much our securities have been affected by this competition, as our stock is not quoted on any of the exchanges. The 4 per cent. bonds, which is the largest bond issue of this company outstanding, were selling on January 1, when the jitneys first put in an appearance in large numbers in San Francisco, at approximately 53. At the present time they are quoted at from 49 to 50.

Trolley Development Stopped

"We have not laid off any men as yet but we are not extending any lines, or buying any new rolling stock and we have no plans along these lines at the present time. We have made several checks on the jitney buses and at the present time there are in the neighborhood of 550 operating in San Francisco. Their average receipts are between $6 and $7 per day."

Some Average $8 a Day

This estimate of average receipts was reiterated by many jitney men. A few take in as much as $8 on an average. A scant half dozen exceed $8, according to their claims, and these boast of a secret system whereby they augment their earnings. They run on regular jitney routes during rush hours; take care of the 10-cent exposition trips during other regular intervals; and at all other times are in the cheap taxi service.

The friendly relations between the jitney men and the city administration are best shown by a recent contract for several day's hire of twenty-five jitneys, paid for by the city. These jitneys were driven through the streets bearing signs asking citizens to vote for the water bonds. When 250 members of the Native Sons lodge wanted to be driven to a barbecue at San Mateo last week, following Native Sons day at the exposition, they bargained for fifty jitneys.

"Most of the jitney men are union mechanics and laborers, out of jobs, and small business men," said Thomas Doyle, secretary of the association. He was one of the pioneers in San Francisco and helped with D. J. Alberga, elected president on April 26, to found the association with about 260 members at the start.

Harvest of Early Days

"Those first days were our harvest," smiled Mr. Doyle. "People were ashamed to give us a nickel then. Ten cents was the common fare, even though we had 5 cents painted on the front of the car. Many quarters were given, too, and our passengers were very polite, taking care to close doors and help us all they could. They are still just as friendly but the service has become so common that a nickel is the established price. I am sorry that we did not start out as dime buses. The extra nickel would have helped to tide us over during this early experimental period, when so many of us are making just a living wage. I believe the public would have paid a dime as readily as a nickel. Then we could have cut down to a nickel later when we had our costs figured out."

The rate of membership to the association is $5 initiation fee. For members admitted during the month of January, dues of $1 a year are charged during 1915; during February, $2; March, $3; April, $4, and May, $5, the maximum.

The association has gone on record against the Cogswell measure which has passed one house of the Legislature and by which jitneys will be taxed $12.50 a seat a year. This has already been amended to provide that should an operator decide to retire from business before the year is out, he will be given a rebate on the amount of tax he has paid.

The city ordinance, however, is approved in the hope that it will remove the irresponsible jitney man from the service and keep off the streets on Saturdays and Sundays the flood of school boys in their fathers' cars, who take the cream of the heavy week-end exposition business.

The ordinance provides for a $10,000 bond, insuring one victim injured or killed in the total sum of $5,000; two or more $10,000, "irrespective of the financial responsibility or any act or omission of said jitney bus owner or lessee."

Insurance the Big Question

Insurance was the big question in discussions between jitney men and the board of supervisors until the Pacific Casualty Co. drew up its policy. Now the jitney men have a policy which meets the city's requirements and also gives the operators $1,000 property protection. This costs $96 a year to association men, payable $24 down and $8 a month. The $24 pays for 3 months in advance and the jitney man can cancel at any time by failing to meet his monthly premium.

This insurance practically is an association affair, as non-members must pay cash and a larger premium and be subjected to an examination. The requirements of the city, the insurance company and the jitney association entirely interlock.

The ordinance further provides for permit fees as follows: $10 per year for a bus seating five passengers or less; $15 for more than five passengers and less than eight; $25 for more than seven and less than sixteen; $40 for more than fifteen. All permit fees are payable in advance.

Requirements for Drivers

The driver has to have 30 days' experience driving on the streets of San Francisco, must have a physical examination and pass an oral examination as to traffic laws. The number of the permit must be displayed in figures at least 3 inches high and 1-2 inch wide on the right side of the body. The driver must wear a badge.

Jitney drivers are not to drink or

smoke when on duty and the car must be washed and cleaned at least once a week, and swept out daily, or oftener when required in writing by the Board of Health. Brakes must be tested daily. Policemen and firemen are to ride free, when seats are vacant. The ordinance is to take effect within 10 days after being signed by the mayor. The police commission is given entire control and may make emergency changes in routes and regulations. It is provided that if any part of the ordinance shall be declared unconstitutional that all of the balance shall be in force.

Among a group of about twenty members of the jitney association, it was agreed that the tire expense of a Ford in daily operation over an average route would be between $15 and $18 a month.

Work on Car an Hour a Day

It is the practice of nearly all jitney men to lay off an hour or 2 in mid-afternoon, during which they work on the car. This time is figured as a part of the time the car is in service.

Gasoline and oil are obtained from the Monarch and Standard Oil companies at rates specially conceded to members of the association, it is said.

A book of coupons entitling the holder to $5 worth of purchases is sold by the Monarch Oil Co. for $4.60. Holders of these coupon books then get gas at 9 1-2 to 9 3-4 cents a gallon while the rest of the city is paying 10 1-2 cents. Some of the better fixed jitney men buy their gasoline in drums. It is said that from 6 to 9 1-2 gallons are used a day in a Ford jitney during 14 hours of service. San Francisco is a very hilly city, with some unusually steep grades on main streets.

One driver, who has a 5-mile run, reports that his gross receipts hover close to $6 daily, of which he pays out about $2 for supplies and parts and earns about $4 a day for himself. He is saving his money and believes he will be able to buy another car when his present Ford wears out. He does not drive on rainy days.

Another man who drives only at night, as he has a job in a garage in the day time, has had to pay $5 for a city vehicle license, $1 for a city driver's license, $2 for a state chauffeur's permit and $10 for a state license for his Ford.

Another Driver Reports

"My buses average $4 earnings a day over and above the cost of fuel and supplies. Some people pay $2 50 a day for drivers. That is the common practice. I won't say what I pay, for that would be giving away one of the basic features of my system. They work in 10-hour shifts, 7 days a week. I never drive, except when one of the men wants to get off. During parts of the day I check my two cars as they go by and see if they need anything.

"I expect to stay in this jitney business. I have a little money and it won't take much to swing this. My system is working fine. A definite amount is laid aside each week to cover half of the cost of a new car in 6 months. By that time I expect to be able to sell my old car at at least half its value when new. My new insurance policy covers smash-ups. So I am thoroughly protected, I feel."

The San Francisco Jitney Bus Assn. maintains a starter, day and night at the ferry, or ferry station, to see that the cars are kept running.

"We have made a few individual sales of new cars," said one of the local dealers, "Installment payment terms are often requested, but of course cash is the only basis. We sold one car to a tailor who had never been in an automobile before. He invested nearly all of his savings and then started to learn. He must have been in too much of a hurry to learn and collect jitney fares. In a week he came to us trembling and said that he was frightened to death when he was at the wheel and begged for his money back. We gave it to him."

Several automobile clearing houses and second-hand departments of large agencies, it is said, are selling cars to jitney men on liberal terms.

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Trolley President Loses Fight to Run Jitneys

BELVIDERE, ILL., May 8—At a meeting of the Belvidere city council, the offer of B. J. Arnold, of Elgin, to operate jitney buses in place of a street railway system, was voted down. Arnold owns the Belvidere street car system but declares that it is a losing proposition. He agreed to operate the buses as often as the citizens thought necessary and tie up the street cars. When the city council declined to consider his proposition, he filed a petition with the Public Utilities Commission, asking that he be released from his contract with the city of Belvidere.

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Developments in Ohio

COLUMBUS, O., May 8—The second stage of the jitney bus development in Ohio has arrived and this is proving even more interesting than the first. The city council of Youngstown, O., is now wrestling with the problem. The ordinance which is pending in the council is drastic and considerable opposition has developed.

In Ashtabula, O., the ordinance recently enacted by the city council was declared unconstitutional by Acting Police Judge Ullman in the first case which came up in his court. H. B. Pierce, a driver, was arrested for operating a jitney bus without the license which costs $100. The defense contended that the license was prohibitive. Immediately upon the decision of the court all of the jitney buses which had stopped operation started business at once. It is said the case will be appealed to the higher courts by the city solicitor.

In Columbus the jitney is developing in a limited degree. A. A. Phillips has purchased four cars which will be used to establish a service from Broad and High streets to Alum creek. Cars will be operated on an 8-minute schedule.

The Jitney Co., of Portsmouth, O., has been incorporated with a capital of $1,000.

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Railways Cut Rates to Meet Jitney Competition

VANCOUVER, B. C., May 8—To meet the jitney competition, the B. C. electric railway has announced a cut in fares, and henceforth will allow eight tickets for 25 cents; these tickets will not be good for transfer. When transfers are wanted the fares will be five cents straight. B. C. interests control all the street railways in the province.

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TACOMA, WASH., May 6—Announcement has been made by the Puget Sound Electric Co. that another reduction in fare will be made between Tacoma and Puyallup, to 10 cents each way, which is a reduction of 25 per cent. This was decided upon on account of the large amount of business being taken away from the company by the suburban auto buses and jitneys.

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Mass. Jitney Bill Defeated

BOSTON, MASS., May 10—The jitney bus bill was overwhelmingly defeated in the House. It required the licensing of all jitneys, and required deposit of a bond for $5,000 for all vehicles of this type carrying passengers for hire.

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Jitney Cop the Latest

ST. LOUIS, MO., May 7—The jitney bus in St. Louis has brought into being the jitney cop. The board of police commissioners has appointed a squad of policemen whose sole duty is to keep the jitney buses on the move. This squad is in addition to the regular traffic policemen at all of the downtown intersections.

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More Freak Ordinances Proposed in Philadelphia

PHILADELPHIA, PA., May 8—An ordinance has been introduced into the select council which if enacted will practically legislate every jitney out of business. The ordinance, which was framed by Councilman Hutt and has been referred to the law committee for action, provides that each jitney must pay a license fee of $75 a year, each driver an individual license fee of $1, each bus owner must

file a $5,000 indemnity bond against accident or failure to comply with the regulations. In addition, every driver must be furnished with an identification card, each car must be registered with the police department, special traffic rules must be adopted, buses must run at regular times over regularly established routes. The routes to be followed must be filed with the police department and any deviation from the regular route costs 50 cents for each change. Overcrowding is forbidden, the police to judge the carrying capacity of the bus.

The Philadelphia Jitney Assn. is up in arms against the drastic provisions of the proposed ordinance. While the association favors a tax and an indemnity bond, it has proposed that they be fixed at $15 and $1,000 or $2,000 respectively and will seek to have the lower amounts substituted. The association now has a membership of 432.

Another bus ordinance has been introduced into councils granting permission to the Midway company to run automobile buses on Broad street, Market street, Girard avenue and the Parkway, and providing an annual license fee of $50 for each bus.

The Practicability of Using the Same Spring Elements for All Motor Vehicles

(*Continued from page* 856)

tribution affect the riding qualities and security, the minor difficulties in applying cantilever springs to a given pleasure car design which was not intended for them in the first place may perhaps equal in importance the more obvious difficulties which apply to heavy vehicles with variable load, and it may be claimed as an all-around advantage of the special form of cantilever springs described as an alternative element in the standardized system that it is more readily interchangeable with half-elliptics, because it affects wheelbase, frame strength, twist, whip and roll in lesser degree than the ordinary cantilever spring. The air spring affords a broad support in the frame, or the support can be divided between the air spring and an ordinary but shortened cantilever spring with fixed fulcrum, on the plan loosely indicated in Fig. 13. By the arrangement of Fig. 14—which of course could be greatly improved by having the frame designed specially for the reception of the air spring—the frame support comes only slightly in advance of the point where it would come with half-elliptics and the same wheelbase. The difference is further reducer by the possibility for using a shortened leaf spring, the air spring supplying the flexibility needed. The drive can evidently be taken through the spring, and its lever, with this and kindred designs, if desired.

"Rocker" Spring vs. Cantilever

As the term "cantilever spring" is not under any circumstances quite appropriate mechanically and the use of a yielding and movable fulcrum involves new properties and new relations to the vehicle design in general, the writer designates the type which has these features as a "rocker spring," this term being short and explanatory. The rocking action not only produces the same properties for which cantilever springs are favorably known but also contributes largely to the progressive resistance to flexion which is the most important characteristic of the proposed combination of an air spring with either a rocker spring or a half-elliptic spring.

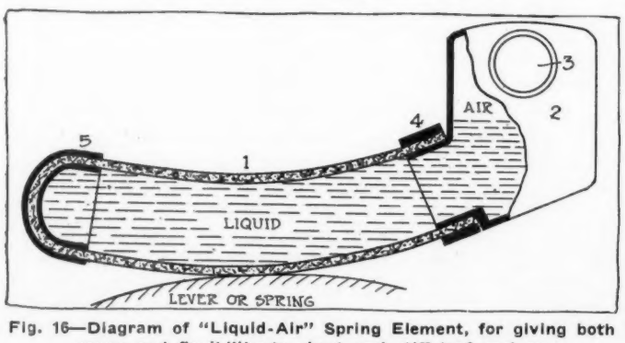

Fig. 16—Diagram of "Liquid-Air" Spring Element, for giving both range and flexibility to short and stiff leaf springs

The "Liquid-Air" Spring

The practicability of the air spring for all sorts of motor vehicles constitutes perhaps the principal point on which practical constructors may be inclined to have serious doubts. The advantages of the elongated and curved form of the flexible portion of the air spring have already been referred to in article XII. It remains to be explained that the means contemplated by the writer for the purpose of keeping an air spring which includes a flexible element from gradually losing its tension by diosmosis, or plain leakage, through the flexible fabric, consists in filling the flexible portion with a liquid instead of with air and joining it to a metallic portion containing air under pressure. Fig. 16 shows the principle. The curved and flexible tube 1, which in the vehicle is mounted with its concave side against a rigid backing on the outside or the inside of the vehicle frame, is very firmly secured to the air chamber 2 by a clamping device 4 and is closed at its other end by metallic cups 5. From the air chamber on one side of the frame a metal tube 3 may lead to the corresponding air chamber on the other side of the vehicle, and the inflation valve may be located in this tube or at the top of the air chamber, as in Fig. 15. The liquid may be water or water thickened with glycerine or, if the flexible tube is made accordingly, it may be tar.

The use of a liquid has several advantages besides that of preventing the air from coming in contact with the fabric and penetrating it. It reduces the air volume for a given bulk of the device and thereby renders it possible to get a strongly progressive tension under increasing load or shock, and coupled with the high tension a relatively slow reaction, as a small quantity of air cannot expand as fast against a given resistance as a larger quantity of the same tension. When the tube is strongly flexed a portion of the liquid which is forced into the air chamber has to pass through the compressed portion of the tube, and this action amounts to damping of the spring action and reaction for especially sharp shocks. Fig. 14 shows a rear mounting and Fig. 15 a front mounting of the "liquid-air spring," as it might be termed, in connection with the "rocker spring" and the "bobcheck." The air chamber at the rear in Fig. 14 is supposed to be connected by a tubular transverse with one on the other side of the vehicle. It may be noted that a flexible tube of, say, 3 inch outside and 2 inch inside diameter can be arranged, on the plan indicated in the sketches, to resist the lever which acts against it for a vertical distance considerably in excess of these dimensions, by reason of the progressive movement of the middle of the fulcrum.

Factory Miscellany

Warner Gear to Add—The Warner Gear Co., Muncie, Ind., will receive bids shortly for a reinforced concrete, two-story, 50 by 97-foot addition to its plant.

Auto Crank Shaft Co. Adds—The Auto Crank Shaft Co., Detroit, Mich., has enlarged the plant on Piquette avenue. A one-story structure, 60 by 120 feet, is now in course of construction.

Detroit Pattern Works Moves—The City Pattern Works, of which Vaughan Reid is president, moved April 24 from its location at 93-95 Catherine street to larger quarters at 73 Shelby street, Detroit, Mich.

Spoke Factory for Waverly—W. O. Nelson, W. B. Hillman and A. W. Lucas will establish a spoke factory at Waverly, Tenn., making a specialty of automobile spokes. They will also put in a planing mill.

Mt. Pleasant Co. Enlarging Plant—The Mt. Pleasant Motor Co., Mt. Pleasant, Mich., which started in business last year to make the M. P. cars, is enlarging its plant. The capital stock of the company is to be increased.

Wheel Factory at Owen Sound—A factory will be built at Owen Sound, Ont., for the manufacture of wheels for automobiles, trucks and all motor vehicles. F. W. Harrison, P. S. Patterson and others are interested.

Buys Land for Automobile Plant—P. A. Seeker, of Mariner City, Mich., recently purchased 3 acres of land just east of London, Ont., for the erection of a $65,000 automobile factory. Some fifty hands will be employed at the start.

To Build Automobile Accessories—Cleveland, O., capitalists have arranged with the Niagara Radiator & Boiler Co., North Tonawanda, N. Y., to operate a plant for the manufacture of automobile accessories in connection with the local factory.

Falls Machine Busy—The Falls Machine Co., Sheboygan Falls, Wis., has increased its working force by nearly 150 men during the last 2 weeks and is working on a night schedule. Shipments of thirty to forty-five motors are going forward daily.

Republic Truck Erects Temporary Shed—A temporary shed, 195 by 60 feet, is being erected by the Republic Motor Truck Co., Alma, Mich., to be used as a warehouse for trucks. It is likely that at some later date a permanent brick building will be erected, the company being in need of larger quarters.

York Body Plant Damaged by Fire—Fire destroyed a portion of the plant of the York Wagon Gear Co., York, Pa., engaged in the manufacture of wagon and automobile bodies, entailing a loss of $10,000. The fire originated in the drafting room and many valuable patterns were destroyed.

Monitor Moves Quarters—The Cummins Auto Sales Co., Columbus, O., has moved from the quarters it formerly occupied on North Fourth street, to a five-story factory at 400 Mt. Vernon avenue. The entire structure is used by the concern for the manufacture of the Monitor four-cylinder cars.

Mich. Auto Dash Plant Burned—The plant of the Michigan Auto Dash Co., Milford, Mich., which is owned by the Detroit Auto Dash Co., was recently burned, causing a loss estimated at $30,000. Officials of the Detroit Auto Dash Co. say that a new plant, 44 by 202 feet, will be built at once. The real cause of the fire has not yet been determined. The plant was turning out about 1,000 automobile dashes a day with a force of about twenty men. When the new plant is completed more men will be employed and the production increased to 1,500 dashes a day. The concern also makes running boards for automobiles.

Marathon Tire Plant Nearly Completed—The Marathon Tire & Rubber Co., Cuyahoga Falls, O., is rushing to completion its factory, which will be four stories with a basement and having a capacity large enough to permit the employment of 350 employees. The building will be of steel and brick with maple floors, modern and sanitary in every detail. It will be built in three sections, two of which are now being hurried to completion. When finished the building will be 300 feet long, 196 feet wide and 96 feet high. It will cost $100,000. William Ridge, of Akron, O., president, announces that he expects to be in the building ready for business within 2 months.

The Automobile Calendar

May 15-16	Vancouver, Wash., Track Races; Northwest Automobile Assn.
May 15-16	Columbus, O., Track Race, Columbus Automobile Club.
May 17	Spokane, Wash., Show, Davenport Hotel.
May 17-18	Boston, Mass., A. A. A. Annual Meeting.
May 18-19	Boston, Mass., annual meeting of the American Automobile Assn.
May 25-26	New York City, National Assn. of Manufacturers' Convention; Waldorf Astoria.
May 27	Chicago, Ill., Sociability Run of Chicago Motor Club to South Bend, Ind., H. H. Robinson.
May 29	Indianapolis, Ind., 500-Mile Race, Indianapolis Motor Speedway.
May 29	Philadelphia, Pa., Stone Harbor Memorial Day Run from Philadelphia.
May 29-30	Seattle, Wash., Track Races; Northwest Automobile Assn.
June 3	New York City, 11th Annual Automobile Outing for Orphans; Orphans' Auto. Day Assn. of N. Y.
June 7-11	San Francisco, Cal., National Electric Light Assn.
June 9	Galesburg, Ill., 100-Mile Race, Galesburg District Fair Assn.
June 11-12	Effingham, Ill., Hillclimb and Fuel Economy Test. Salt Creek Hill, Effingham Automobile Club.
June 12	Brighton Beach, Track Race; E. A. Moross.
June 14-17	Detroit, Mich., Summer Meeting of the Society of Automobile Engineers and Start of Cruise to Georgian Bay.
June 19	Chicago, Ill., 500-Mile Race, Chicago Speedway.
July 3	Sioux City, Ia., 300-Mile Race, Sioux City Speedway Assn.
July 4	Visalia, Cal., Road Race; Tulare County Automobile Assn.
July 4-5	Tacoma, Wash., Road Race, Tacoma Speedway Assn.
July 5	Omaha, Neb., Speedway Races, Omaha Motor Speedway.
July 5	Visalia, Cal., Road Race, Tulare Co. Auto. Assn.
Aug.	Milwaukee, Wis., Independent Petroleum Marketers' Assn. of the U. S.; 1915 Convention in Milwaukee.
Aug. 2-3	San Francisco, Cal., Tri-State Good Roads Assn., Third Annual Convention.
Aug. 20-21	Elgin, Ill., Road Races.
Sept.	Indianapolis, Ind., Fall Show, Indiana State Fair.
Sept.	Peoria, Ill., Second Northwestern Road Congress.
Sept. 6	Providence, R. I., Speedway Race; F. E. Perkins.
Sept. 6	Detroit, Mich., Speedway Race; Detroit Speedway Club.
Sept. 13	Oakland, Cal., Pan American Road Congress.
Sept. 17-18	Peoria, Ill., Illinois Garage Owners' Assn. Convention.
Sept. 20-25	San Francisco, Cal., International Engineering Congress.
Oct. 1-2	Trenton, N. J., Track Races; Inter-State Fair.
Oct. 6-16	New York City, Ninth Electrical Exposition and Motor Show at Grand Central Palace.
Dec. 31	New York City, Show; Grand Central Palace.
Jan. 22, 1916	Chicago, Ill., Show; Coliseum.

The Week in the Industry

Heath Heads Singer N. Y. Sales—J. K. Heath, Jr., has been appointed sales manager of the Singer Motor Co. branch in New York City. He was formerly connected with Simplex company in Boston in the capacity of salesman.

Turner Sales Manager of Air-in-Al Co.—W. M. Turner, formerly sales manager for Paige cars in New York City, has been appointed sales manager of the Woodbridge Chemical Co., the distributor in Air-in-Al, and has established salesrooms in the U. S. Rubber Bldg. The product is a puncture preventive for automobile tires.

Neal and Deane Head New Chicago Branches—Two new automobile branches have been established in Chicago, Ill., namely, the Abbott-Detroit and the Lozier. The first branch will be managed by B. B. Neal and will be located at 2436-2438 South Michigan avenue; the second will be managed by J. R. Deane, located at 918 Michigan avenue, Chicago.

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Garage

Seattle's New Garage—Construction has commenced on a $20,000 two-story brick and concrete garage at Seventh avenue and Westlake avenue, Seattle, Wash., known as Times Square, and will be leased for 5 years to the Westlake Garage Co.

New Garage to Be Detroit's Largest—What is said to be the largest and most complete garage in Detroit is the one of the Detroit Athletic Club, to be erected upon a plot of ground 120 by 100 feet on Randolph street opposite the club. It will be a six-story building having 72,000 square feet of floor space. The frontage will be of white stone and will correspond in appearance to the frontage of the athletic club. On the ground floor there will be the offices, an automobile supply and accessory department and a taxi and limousine department for the exclusive use of members. On the top floor will be a most complete repair shop and an electric charging equipment. The other floors will be used to store and take care of cars. A company known as the D. A. C. Garage has been incorporated with a capital stock of $30,000 to look after the garage business. J. H. Thompson, of the Thompson Auto Co.; John Kelsey and W. E. Metzger are the incorporators. Mr. Thompson has been appointed president and general manager of the garage.

Motor Men in New Roles

Prasp Heads Oregon Oakland—The Oregon Oakland Motor Co., Portland Ore., with F. W. Prasp, president, and E. D. Van Dersal, vice-president and general manager, has been established.

Sinclair Gets New Job—H. J. Sinclair has been appointed manager of the Boston branch of J. C. Tucker, Chase agent in New England. He was for 3 years with the Peerless forces.

Eckert Succeeds Sells—Hayes Eckert has been appointed San Francisco manager of the Earl C. Anthony, Inc., California distributors of the Chalmers and Grant cars, succeeding E. N. Sells.

Cuniff Savage Tire Advertising Mgr.—L. J. Cuniff, of the advertising department of the M. Rumely Co., Laporte, Ind., left the service of that company May 1 to become advertising manager of the Savage Tire Co., San Diego, Cal.

Pope Lozier Factory Representative—H. W. Pope, formerly a Lozier dealer in Omaha, Neb., has been appointed direct factory representative in the states of Iowa, South Dakota, North Dakota and Nebraska. His headquarters will be in Omaha.

Smith Is New Manager—R. E. Smith, formerly of Providence, R. I., has been appointed manager of the Worcester branch of the United States Tire Co., succeeding J. R. Whitmyer, who resigned recently to accept another position.

Page Goes to Portland—P. W. Page, for some years with the B. F. Goodrich Tire & Rubber Co., Cincinnati, O., has been appointed manager of the company's branch at Portland, Me., succeeding S. E. Westcott, who has become a traveling salesman for the branch.

Frederick in Business—W. A. Frederick has organized a company and opened salesrooms at 293 Northampton street, Boston, for the Frederick Quick Service Rim that comprises an extra rim and tire to be clamped outside a wheel whose tire is punctured, and so avoid the delay in pumping up the tire until the day's work is over.

Gardham Resigns—Joseph Gardham, a veteran of the Detroit automobile field, who entered the manufacturing end in 1899 with the Olds Motor Works, and passed from that company to the employ of W. E. Metzger and the Wayne company, has resigned as chief inspector of the Hudson Motor Car Co., a position he has filled for 2½ years.

McGrath Starts Co.—E. A. McGrath, who was identified with one of the Boston agencies handling the Palmer Singer some time ago, has gone into business for himself, having formed the Premier Auto Repair Co. that is furnishing commercial bodies for Ford chassis. He has opened quarters on Northampton street, Boston.

Webb Atlanta Studebaker Mgr.—A. C. Webb, well known in the racing field as a driver of the Pope-Toledo racing cars, and for many years engaged in the fire engine business, has been appointed manager of the Atlanta (Ga.) branch of the Studebaker Corp., Detroit, Mich., after having served for about 3 months as commercial car manager of the company's New York field.

Leverton Chalmers Superintendent—A. C. Leverton has been appointed general superintendent of the Chalmers Motor Co., Detroit, Mich. During the last 2 1-2 years Leverton was with the Cartercar Co., Pontiac, Mich., as factory manager. Before going to Pontiac he was during 4 1-2 years with the old Brush company as superintendent and also as factory manager. L. F. Johnson, formerly connected with the Willys-Overland Co., has become district sales manager of the Chalmers company and is in charge of Southeastern territory.

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Dealer

Detroit Agents Move—Cutting, Armstrong & Smith, automobile manufacturers' agents, have moved to new quarters at 799 Woodward avenue, Detroit, Mich.

New Detroit Electrical Supply Co.—The Detroit-Pittsburg Electric Specialties Co., Detroit, Mich., has started in business at 997 Woodward avenue. The company handles all kinds of electrical supplies.

Vanguard Windshield's Detroit Branch—The Vanguard Mfg. Co., Detroit, Mich., which makes windshields, has opened a branch at 807 Woodward avenue where the new Ford windshield selling at $7.50 is on display.

New Philadelphia Simplex and Dodge Station—The Thornton-Fuller Automobile Co. has taken title to the property at 312 and 314 South 24th street, Philadelphia, Pa., and after extensive alterations will occupy it as a service station for the Simplex and the Dodge cars.

Automobile Agencies Recently Established

Alabama

Gadsden	Chandler	Gadsden Hdw. & S. Co.

Arkansas

Little Rock	Premier	C. L. Omchundre
Little Rock	Chandler	G. L. Omohundro
Pine Bluff	Oldsmobile	J. F. Rutherford

Arizona

Douglas	Chandler	Southern Arizona Auto Co.
Kingman	Maxwell	W. G. Wagner
Phoenix	Mitchell	Oscar Irvin
Thatcher	Maxwell	Thatcher Imp. & Mer. Co

Canada

Fredericton	Saxon	J. Stewart Neill
Montreal	Hupmobile	Jack O Brien Automobile Co.
Toronto	Saxon	Automobile & Supply Co., Ltd.
Underwood	Saxon	Simon Roppel
Vancouver Island	King	Thomas Plimley
Vancouver	King	A. S. French
Vancouver	Hupmobile	Begg Motor Co.
Vancouver	Saxon	Hoffmeister Bros., Ltd.

California

El Centro	Maxwell	A. L. Luce
El Monte	Maxwell	El Monte Garage
Fresno	Oldsmobile	Neideraur Motor Car Co.
Hollywood	Maxwell	C. F. Little
Hollywood	Pullman	Hollywood Mission Garage
Live Oak	Studebaker	Live Oak Garage Co.
Long Beach	Metz	Wm. P. West
Long Beach	Detroiter	B. Gunsul
Long Beach	Pullman	Schilling & Evans
Los Angeles	Commerce	H. G. Pendell
Los Angeles	Premier	Smith Bros.
Monrovia	Metz	A. T. Badillo
Monrovia	Reo	A. T. Badillo
Newman	Oldsmobile	Simon Newman Co.
Oxnard	Kissel	J. L. Milligan
Pasadena	Oldsmobile	Oldsmobile Sales Co.
Pasadena	Pathfinder	H. L. Nelson
Pomona	Maxwell	E. E. Booth
Rialto	Metz	A. W. Cramp
Redondo	Pullman	Marshal Craig
Santa Ana	Maxwell	C. B. Perry
San Bernardino	Maxwell	Conqueror Mfg. Co.
San Bernardino	Trunbull	E. W. Lockwood
San Jacinto	Maxwell	Stuart & Smith
San Pedro	Metz	A. L. Drake
Ventura	Studebaker	J. E. Stuart

Colorado

Avon	Apperson	G. C. Nottingham
Berthoud	Chevrolet	J. V. Sans
Berthoud	Monroe	J. V. Sans
Boulder	Apperson	Avery Auto Co.
Boulder	Metz	J. A. Outhier
Briggsdale	Metz	A. McDowell
Brush	Apperson	A. H. Frerichs
Canon City	Dodge	Canon City Auto Co.
Craig	Cartercar	E. Gust
Craig	Metz	E. Gust
Colorado Springs	Metz	E. I. Walsh
Colorado Springs	Pilot	W. W. Price
Denver	Chalmers	Platt-Fawcett Motor Co.
Denver	Dort	J. S. Morrison Auto Co.
Denver	Hupmobile	J. S. Morrison Auto Co.
Denver	White	Dean M. Gillespie
Eads	Chevrolet	R. W. Wansted
Eads	Monroe	R. W. Wansted
Fairplay	Apperson	H. Bergstrand
Flagler	Cartercar	L. Clark
Flagler	Metz	L. Clark
Ft. Collins	Metz	L. W. Van Dyke
Ft. Lupton	Metz	E. Lewis
Fraser	Detroiter	F. H. Harrison
Fruita	Detroiter	L. D. Nelson
Genoa	Cartercar	W. P. Jones
Genoa	Metz	W. P. Jones
Grand Junction	Saxon	Western Slope Auto Co.
Greeley	Apperson	Dan Straight
Greeley	Oldsmobile	Straight & Son
Greeley	Metz	F. P. Meeker
Greeley	Cartercar	F. P. Meeker
Greeley	Detroiter	S. P. Massey
Haxtum	Metz	T. Sharp
Hillrose	Metz	J. E. Boillot
Holyoke	Chevrolet	J. A. Peterson
Holyoke	Monroe	J. S. Peterson
Idaho Springs	Chevrolet	Emmet F. Galligan
Idaho Springs	Monroe	Emmet F. Galligan
Iliff	Metz	W. F. Alexander
Lamar	Chevrolet	J. G. Trefz
Lamar	Monroe	J. G. Trefz
Longmont	Detroiter	D. I. Benson Auto Co.
Loveland	Chevrolet	B. Rarie
Loveland	Monroe	B. Rarie
Mattison	Metz	K. Koontz
Meeker	Chevrolet	H. Gordon
Meeker	Monroe	H. Gordon
Montrose	Pilot	John Hodges
Monte Vista	Metz	I. A. Bond
Nucla	Detroiter	M. W. Winter
Pueblo	Chevrolet	Knebel Automobile Co.
Pueblo	Detroiter	Dick Brige
Pueblo	Metz	F. S. Hamilton
Pueblo	Monroe	Knebel Automobile Co.
Pueblo	Pilot	E. I. Crockett
Rawlins	Chevrolet	M. M. Rubner
Rawlins	Haynes	M. M. Rubner
Rawlins	Monroe	M. M. Rubner
Rifle	Metz	J. B. Ruple
Rocky Ford	Metz	J. C. Cartwright
Saguache	Metz	J. J. Keller
Simla	Metz	C. C. Whiteaker
Steamboat Springs	Chevrolet	L. L. Brown
Sterling	Metz	Ideal Auto & Machine Co.
Steamboat Springs	Monroe	L. L. Brown
Windsor	Chevrolet	Kindred & Evans
Windsor	Monroe	Kindred & Evans

Connecticut

Bridgeport	Premier	Fairfield Auto Co.

Georgia

Albany	Studebaker	S. B. Brown Co.
Tate	Studebaker	H. Y. Atwood

Idaho

Kuna	Premier	R. T. Walbank
Pacatello	Saxon	Holt Auto & S. Co.

Illinois

Alton	Chandler	Alton Auto Co.
Byron	Oldsmobile	L. D. Marshall
Cairo	Saxon	Cairo Motor Co.
Cairo	Studebaker	Illinois Auto Co.
Champaign	Premier	H. H. Harris, Jr.
Chicago	Chandler	Harvey Taxicab Co.
Chicago	Monarch	Crown Motors Co.
Chicago	Premier	Western States Automobile Co.
Elburn	Oldsmobile	Shannon St. Garage
Elgin	Chandler	A. F. Luscher
Fairfield	Saxon	H. O. Brockett
Fairfield	Studebaker	Wilson & Bestow
Freeport	Moline	G. W. Brokhausen Auto Co.
Forreston	Moline	Abels & Korf
Galesburg	Chandler	A. H. Schwank
Kankakee	Oldsmobile	Kankakee Motor Car Co.
Libertyville	Moline	Ree Motor Co.
Manito	Moline	L. Heckman
Marion	Saxon	Marion Saxon Co.
Mexico	Chandler	Paul E. Coil
Monroe Center	Chandler	Atchison & Hildebrand
Niantic	Moline	H. O. Bruce
Oakwood	Moline	B. W. Neel
Orion	Moline	Rohrbach & Keel
Peoria	Monarch	Isch Bros. & Hackshaw
Rockford	Moline	Lundstrom Bros.
Somonauk	Moline	Wm. B. Dolder
Staunton	Chandler	C. Blackwell
Sterling	Chandler	I. Hoppler
Sycamore	Oldsmobile	E. A. Little
Taheran	Chandler	E. P. Benscote.
Tuscola	Pilot	F. Wilson

Indiana

Akron	Saxon	K. Gast Co.
Brookston	Studebaker	M. E. Bennett
Fort Wayne	Premier	C. Q. Ross
Indianapolis	Moline	Detroit Elec. Sales Co.
La Porte	Saxon	Henry Bros. & Sharp
Plymouth	Saxon	F. H. Kuhn
Rochester	Oldsmobile	F. Stinson
Silver Lake	Pilot	W. C. Lotz
Terre Haute	Oldsmobile	Cole Auto Co.
Vevay	Studebaker	H. B. Dupraz
Vincennes	Saxon	Johnson Auto Co.
Winama	Saxon	E. Zellers

Iowa

Avoxca	Moline	Pratt & Jensen
Beloit	Chandler	O. L. Logan
Cherokee	Franklin	E. J. Lauer
Clare	Chandler	Donahue & Donahue
Clarion	Chandler	J. T. Jenson
Council Bluffs	Monarch	C. A. Morgan
Denison	Chandler	Louis M. Coon
Des Moines	Chandler	Des Moines Jeffery Co.
Dubuque	Franklin	Byrne Brothers
Jewell	Chandler	Iver Iverson
Knierum	Chandler	Freimuth Auto Co.
Lake Mills	Chandler	Winnebago Auto Co.
Manchester	Premier	M. D. Arnold
Monmouth	Moline	H. R. Miller
Neola	Chandler	T. W. McDermot
Nugent	Chandler	L. F. Richardson
Osage	Studebaker	Gardner Motor Co.
Rock Rapids	Studebaker	Holliday Bros. & Smock
Spencer	Chandler	Hurd Auto Co.
Victor	Moline	G. P. Mohr
Waterloo	Moline	C. Bixler
Wellsburg	Premier	Koolman Auto Co.
Wilton Junction	Moline	H. P. Mason

Kansas

Atchison	Herff-Brooks	F. R. Beck
Burrton	Herff-Brooks	I. E. Dundon
Centralia	Hollier	Wait Auto Co.
Emporia	Herff-Brooks	Strube Motor Co.
Haddam	Herff-Brooks	E. W. Shearburn
Hays	Herff-Brooks	A. Herl
Larned	Hollier	Young & Co.
Lawrence	Herff-Brooks	C. W. Smith
Lehigh	Herff-Brooks	Lehigh Land Co.
Olmitz	Herff-Brooks	Hickey & Galiardt
Ottawa	Herff-Brooks	Lathrop Hardware Co.
Salina	Herff-Brooks	W. B. McCall
Stafford	Herff-Brooks	Fritzmeier & Hewit
Topeka	Herff-Brooks	Mills Imulement Co.
Wichita	Herff-Brooks	Heskett & Myers

Kentucky

Carrollton	Case	C. Deweese
Covington	Case	Hansen Hdwe. Co.
Elizabethtown	Case	A. H. Miller Imp. Co.
Glasgow	Case	Bradford Bros.
Helena Sta	Case	E. G. Davis
Henderson	Case	I. O. Clore & Son
Hodgensville	Case	D. E. Patterson
Lebanon	Case	Rubel-Able Hdwe. Co.
Lewisport	Case	I. B. Taylor
Hopkinsville	Case	I. J. Metcalfe
Lawrenceburg	Case	Mahan & McAfee
Liberty	Case	Young & Rule
Paducah	Chandler	H. A. Potter Supply Co.
Princeton	Case	E. L. Pickering
Providence	Case	J. F. Montgomery
Richmond	Chandler	Citizens Garage
Smiths Grove	Case	Wright Bros.
Springfield	Case	McClure & Mays
Springfield	Hudson	Hagan Brothers
Waverley	Case	J. C. Wolflin
Winchester	Saxon	J. O. Tyler

Maine

Augusta	Saxon	Arsenal St. Garage
Bangor	Chandler	A. A. Richardson
Kennebunk	Oldsmobile	F. X. Lord
Oldtown	Chandler	Oldtown Motor Co.
Portland	Oldsmobile	W. V. Worcester & W. H. Alexander
Presque Isle	Saxon	A. J. Brown
Skowhegan	Saxon	A. B. Borden

Maryland

Baltimore	Regal	Regal Auto Co.
Hagerstown	Oldsmobile	C. E. Shenk

Massachusetts

Boston	Pilot	Hayes-Johnson Co.
Boston	Saxon	M. Ross Maddocks Co., Inc.
Boston	Waverly	F. E. Wing
Fitchburg	Saxon	Lesure Bros. Garage
Hudson	Saxon	F. B. Dawe
Lawrence	Saxon	A. J. Mills
Manchester	Winton	H. W. Edgar
Quincy	Reo	T. W. Hodgkinson
Springfield	Briscoe	Philbrook Motor Car Co.
Springfield	King	Bennett Motor Car Co.
Taunton	Saxon	H. C. Perry
Wakefield	Ford	J. A. Steele
Webster	Saxon	Ryan & Ryan
Williamsburg	Saxon	R. F. Burke
Worcester	Metz	Metz Motor Car Co.
Worcester	Oakland	R. L. Greene
Worcester	Saxon	New England Supply Co.

Michigan

Albion	Regal	Rex Mock
Alma	Chandler	G. W. Moore
Baldwin	R-C-H	Cashion & Fisher
Battle Creek	Chandler	Heyser-Finlay Motor Co.
Battle Creek	Chandler	Heyser-Finlay Motor Co.
Benton Harbor	Oldsmobile	Crary Mch. Wks.
Big Rapids	Saxon	Phelps & Ferris
Brodhead	Buick	Eggen & Bertness
Brodhead	Dodge	Eggen & Bertness
Brodhead	Moon	Eggen & Bertness
Caseville	Oldsmobile	W. E. Watterworth
Charlevoix	Ford	B. Brown
Cheboygan	Chandler	Schulz Bros.
Chetek	Buick	F. A. Richards
Chetek	Ford	F. A. Richards
Chetek	Paige	F. A. Richards
Clio	Studebaker	R. R. Knight
Cohoctah	Saxon	F. E. Lott
Colon	Saxon	C. F. Hafer
Detroit	Marmon	W. H. Brear
Detroit	Monarch	W. R. Bamford
Delavan	Studebaker	H. Jones
Dowagiac	Chandler	Nelson & Neff
Dowagiac	Premier	Richey & Baker
Dowagiac	Saxon	Carl Luke
East Troy	Dodge	Krueger & Peterson
Escanaba	Chandler	Gust Larsen
Fond du Lac	Buick	Fond du Lac Auto Co.
Fond du Lac	Cadillac	Fond du Lac Auto Co.
Gaylord	Ford	Chalker & Murray
Grafton	Oldsmobile	Clausing & Kranx
Grand Rapids	Hollier	Smith-Allen Co.
Grand Rapids	Mitchell	Western Michigan Motor Co.
Grand Rapids	Regal	J. E. Daly
Grand Rapids	Scripps-Booth	G. S. Thwing & Co.
Grand Rapids	Westcott	S. A. Dwight
Hart	Hupmobile	Kent Garage
Holly	Grant	J. R. Inskeep
Houghton	Coey Jr.	Legris Bros.
Jefferson	Overland	Kiltz-Bieck Auto Sales Co.
Kalamazoo	Chandler	G. Boyles
Lakeview	Oldsmobile	G. Johnson
Manistique	Oldsmobile	Wm. S. Howe
Manistee	Paige	National Garage
Marlette	Chandler	W. D. Matthews
Marquette	Marmon	Cloverland Auto Co.
Mason	Ford	D. G. Barr
Monroe	Saxon	Jaeger Brothers
Mt. Clemens	Monarch	D. W. Wallace
Munising	Kissel	E. A. Oulette
Newaygo	Overland	Newaygo Garage
Ontonagon	Dodge	Cox-Scott H'dware Co.
Owosso	Chandler	Richard Ferris
Redford	Oldsmobile	F. M. David
Romulus	Monarch	C. L. Rutter
Saginaw	Franklin	F. H. Witters
Seymour	Ford	August Brandt Auto Co.
Sussex	Overland	A. Russell
Three Rivers	Auburn	Slote & Godshalk
Waukesha	Studebaker	G. Savage
Ypsilanti	Monarch	Cook-Powell Auto Sales Co.

Minnesota

Cloquet	Oldsmobile	Cloquet Auto & S. Co.
Duluth	Stearns	Minnesota Auto Co.
Minneapolis	Moline	A. M. Choate Auto Co.

Mississippi

Natchez	Saxon	Stewart & Feltus

Missouri

Hannibal	Monarch	Empire Motor Co.
Kansas City	Hollier	Gate City Motor Co.
Mt. Vernon	Herff-Brooks	J. W. Qualls
St. Genevieve	Studebaker	St. Genevieve Imp. & Auto Co.
St. Joseph	Herff-Brooks	H. A. Hall
St. Louis	Premier	Frye Motor Car Co.

Montana

Billings	Chandler	L. W. Swords
Lewiston	Chandler	Wright Land & Invest. Co.
Lewiston	Franklin	F. E. Doran